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Household Structure and Economic Outcomes: Time Use, Employment, and Educational Attainment

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Household Structure and Economic Outcomes: Time Use, Employment, and Educational Attainment

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Household Structure and Economic Outcomes: Time Use, Employment, and Educational Attainment

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Three topics related to the role of family in economic outcomes are examined. In Chapter 1, a twins instrument is used to measure the effect of an additional infant on womens housework and market work hours and the on time use of others in the family. Having an additional child increases womens weekly housework by 3.5 hours and reduces womens weekly leisure hours by 1.2 hours. Spouses have an increase in housework of 1.1 hours but no reduction in leisure. Chapter 2 develops a simple model to explain how one way in which self-employment might be advantageous to immigrants. Immigrants with poor English language skills cannot realize their full productive ability when dealing with English speakers. However, forming a partnership with someone else who speaks both languages could allow specialization of jobs that would give both a higher wage. The presence of both good and poor English skills in the

household presents the opportunity for mutually beneficial cooperation. The range of English skills of workers in the household is positively associated with higher self-employment probabilities for men, particularly for households with more earners. Individuals have a higher probability of being self-employed if they have someone with different language skills in the household. Chapter 3 examines the effect of additional siblings on childrens education using twins instruments. Additional siblings have a significant negative impact on the education of younger children. Afterwards, children catch up. Closely spaced siblings have a larger negative effect. There is evidence that a girls education is hurt more than that of a boy by an additional sibling in a family with at least three children.

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Chapter 1

Introduction

The family plays an important role in the economic lives of individuals. Families cooperate in home production and the raising of children, allowing specialization of tasks within the household and in the market. They share resources of time, money, and human capital. There is ample evidence that family members bargain among themselves. Thus, even in a context of the maximization of individual utility, the family unit influences the economic decisions and outcomes of its members.

Some of the most important questions concerning the home production role of the family deal with the impact of additional children. However, examining the impact of household fertility on other outcomes poses several problems. Underlying preferences and beliefs about social roles for men and women are likely to influence both fertility decisions and decisions about education, choice of partner, occupational choice, and sector of work. Thus, while women with more children tend to work more in home and have children with less education, it cannot be said how much of the difference between them and women with fewer children is due to the presence of additional children without accounting for this endogeneity. Endogeneity will also result if family

decisions are taken simultaneously with decisions about how many children to have. While these problems are commonly acknowledged, it is difficult to find valid instruments for household fertility, and there are few data sets which contain information on the household and are large enough to use instruments which do exist.

Another important question is how the family influences work decisions. Decisions about self-employment may be related to the family in several ways. Families may contribute resources which enable self-employment, such as financial support, knowledge and experience, and access to benefits. Self-employment also seems to provide flexibility for women who have small children.

In this thesis, I address three questions related to the role of family in home production, the self-employment decision, and children's education. The second chapter provides an exogenous estimate of the amount of time children cost in terms of additional housework and reduced leisure. The third chapter creates a model in which self-employment allows cooperation between family members with different English skills. The fourth chapter investigates whether additional children hurt the education of siblings.

In the second chapter, "The Effect of a Marginal Newborn on Family Time Use: A Twins Approach," I examine the time cost of a marginal child. Understanding women's housework response to children is important on its own because housework and child care are important parts of women's total welfare. More information on women's time use in the home may also have

practical applications in designing work arrangements that enable women to combine having children and market work. Having an additional measure of the cost of children would also be good, given that most measures of child cost have focused on financial factors.

However, naïve estimates of the change in work hours when a child is born are likely to be biased because women may make decisions about how many children to have and the division of time between the market, housework, and leisure at the same time. Underlying preferences that influence both choices also lead to endogeneity and biased estimates.

To get around this problem, I use a twins experiment to estimate the effect of an additional child on housework hours. The birth of twins acts as an exogenous shock to total household fertility. I analyze the effect of young children 15 months of age and younger. This focuses on children when they are likely to have the largest impact on a woman's time and avoids confusing the issue of the cost of child with decisions about future fertility. Others have used twins as a natural experiment to examine women's market work decisions, but no analysis has provided an estimate of the effect of an exogenous additional child on women's housework hours.

The analysis is enabled by using a unique question from the Mexican Survey of Urban Employment (ENEU), a large household dataset with a panel of up to 15 months. This survey asks family members how many hours were spent in housework in the previous week. I compare the housework hours of parents of twin infants with those of singleton infants. The short panel also

allows me to obtain an OLS estimate for the effect of moving from 0 to 1 child for women who will have one child within a year of being surveyed.

Mexico is an interesting country for this analysis because it combines elements of a more traditional, developing country with those of a developed industrialized society. Until relatively recently, birth rates in Mexico were high and women worked primarily in the home or informal sectors. Since the 1960's, Mexico has undergone a dramatic transformation in household structure and women's time use. Average family size has decreased, while women's labor force participation has increased dramatically. Parker and Pederzini (2001) claim that from 1970 to 1990 Mexico had the greatest increase in women's labor force participation in Latin America. An expansion of opportunities in jobs requiring relatively more skills have contributed to women's increasing education rates. This means that there is large variation in household structures in Mexico, from very traditional households where women have a strong focus on home production to smaller families where women work outside of the home.

I find that small children have a significant positive effect on women's housework hours, but less than simple OLS estimates indicate. A small child increases housework for women by 3.5 hours a week. About 1.3 hours comes from a reduction in leisure, and the rest from a reduction in work hours. There is no significant impact on men's housework hours. There is also no differential effect on hours of the child's gender. These results are rather small, and suggest that other factors, such as timing of child care activities, may have a greater

impact on women's work than the total hours would suggest.

The third chapter, "Helping the Family: Immigrant English Skills and Self-Employment," develops a model of self-employment as a coping strategy for immigrants. This chapter explores the hypothesis that self-employment allows immigrant family members with complementary language skills to tailor jobs to maximize total income. Workers who cannot speak English fluently are less productive in the U.S. labor market than they would be working in their own language, and there is a wage penalty to poor English skills both in market work and in self-employment. However, such workers could increase productivity by forming a partnership with someone who spoke English well and could take over aspects of the job that required English skills. The family is the natural basis for forming such partnerships, both because family members provide an available pool of co-linguists and because monitoring and transaction costs are less for family members. If the model holds, individuals from families with a mix of English skills should be more likely to be self-employed.

The U.S. Census offers a possibility to examine this hypothesize by including detailed questions about respondents' country of origin and native language, self-employment status, and English ability.

The data show that household language skills are important for the self-employment decision. Controlling for personal characteristics and the average age, experience in the U.S., and education of all workers in the household, the range of English skills of workers in the household has a positive association

with men's self-employment probability. The effect is particularly strong in households with more earners. Individuals have a higher probability of being self-employed if they have someone with different language skills in the household. Poor speakers are more likely to be self-employed the more good or very good English speakers are in the household, and very good English speakers are more likely to be self-employed the more nonspeakers are poor speakers are in the household. The result is robust across alternative specifications and the general pattern holds for all immigrants except those born in Europe.

These results indicate that policy makers wishing to use self-employment as a vehicle for poverty alleviation may wish to focus not only on individuals, but on household level skills. It emphasizes the importance of family for integration into the work force, and that those without family support or with smaller families may be more vulnerable economically. Finally, it provides evidence that there are secondary benefits to language training.

The fourth chapter is "Quality vs. Quantity: the Effect of an Additional Child on Sibling Educational Attainment." The presence of additional children in the family could reduce the education of siblings for several reasons. Having more children reduces the level of monetary and time resources available for each child and may increase the demand for older siblings to work instead of study. However, the hypothesis that there is a tradeoff between the quantity of children in a family and their "quality" or educational level is difficult to estimate because family size is likely to be correlated with unobserved variables related to parents' decisions about education and family size. Parents who

want large families may place a different value on education, or the education of women may influence both their decisions about how many children to have and the level of education they desire for each child.

A twins instrument provides a way to measure the effect of an additional sibling on its own apart from underlying family preferences. Using the ENEU data set, I examine how an additional child affects the education of siblings. I also examine whether closely spaced siblings hurt each other's education and whether having a young child in the household negatively impacts the education of teenage girls.

Again, the Mexican example provides interesting insight into a developing economy with both traditional and modern elements. Mexico has a well developed public schooling system which has expanded mandatory primary school coverage across the entire country since 1960. Secondary school is also compulsory in Mexico. However, there are still strong competing pressures on children's time, and a significant number children begin helping out early in both work in the house and income generating activities. Knaul (2001) estimates that 24.1% of men and 9.6% of women 18-39 began working before the age of 12 in 1995, not including contributions to housework. An additional child might be expected to have a larger effect in this context than it might in the United States and other more industrialized countries.

The data does not provide support for the quality-quantity model. There is a negative effect on the years of completed schooling relative to similar children who do not have twin siblings, but only for children 6–11. Children

catch up and there is no observed effect by the time children are 12–15 years of age. In fact, in some specifications additional children seem to be associated with higher educational attainment. This does not mean there is no negative effect — there may be biases which would tend to lower the magnitude of the effect of an additional sibling or to make it more positive. There is no evidence that girls are hurt by having young siblings. Having an additional close sibling has a large negative effect. When siblings are closely spaced, a younger sibling is hurt more in terms of education than a older sibling. However, even in this case, the effect diminishes as children get older.

This suggests that siblings do have an effect on a child's education, but primarily when they are young. It may be that they are competing for resources and pulling each other back. Alternatively, mothers with an additional small child may have a lower cost of keeping children at home longer. However, in the context of a fairly developed public education system, it does not appear that additional children reduce siblings' years of completed education in the long run.

This research shows the importance both of considering the role of family in economic outcomes and in finding ways to account for the endogeneity of many variables of interest in examining the family. An additional child has less impact than might be expected on women's time use and the education of siblings when endogeneity is controlled for. However, there are significant short-term results suggesting that the total fertility has less of a role in the context of Mexico than the presence of a small child at any given moment.

There is evidence of specialization both in the greater role that women take in child care and in the evidence on English skills of immigrant households. Family members are able to cooperate to increase welfare. This type of cooperation shows an advantage of organizing as a family not only in home production, but in some instances in market production as well.

Chapter 2

The Time Cost of a Marginal Newborn A Twins Approach

2.1 Introduction

How much time women spend taking care of children is an important question. Many women spend much of their work time in home production activities. Even women who work full-time in the market often devote a substantial number of hours to work in the home as well. Given the amount of time spent on housework and the significance it has for women's well-being, it would be good to have reliable estimates of how family structure influences housework hours. The effect of an additional child on housework hours is of particular interest. Not only does child care make up a large percent of housework hours, but children may be the primary reason women decide to remain in the home.

An estimate of the time cost of children would also be useful in understanding women's market labor supply decisions. The disproportionate responsibility women take in caring for children influences broader decisions about whether to stay in the home or work and what types of work to take. Because of this, child care responsibilities are often seen as a key factor under-

lying differences in men's and women's labor market outcomes. Young women who want a family expect that they will spend substantial amounts of time caring for children and the home, which influences their choice of education and occupation. They may seek jobs that offer flexibility or low penalties for periodic absences from the market, but lower wages. A concentration of women in these occupations can further depress pay scales. The effort and flexibility that children demand reduce the effort women can expend in market labor, and women who take time off from work to care for children have less overall experience and fewer promotional opportunities. These factors work to reenforce women's comparative advantage in the home relative to men, leading women to specialize even more in home production.

There are advantages to producing many child-related inputs in the home rather than purchasing them on the market, especially when children are small. Technological advances and modernization have created a wide range of substitutes for other aspects of home production, but market alternatives remain imperfect substitutes for family-provided child care. Some aspects of child care, such as bonding with the child, are unavailable on the market. Substitutes that do exist, such as babysitters and child care, are difficult to monitor. The cost of even a short period of poor care can be extremely high. Thus, it is likely that even parents with high opportunity costs will increase home production when they have a child.

Given the concern over finding ways to make it easier for women combine work and family, any information which contributes to understanding

how children affect women's time use in the home is important. Employers increasingly realize the value of offering flexible work schedules and other incentives to retain employees who have small children. If women were able to maintain stronger ties to the workplace while having children, the long-term costs of a child would be lower.

This paper analyzes the impact of a marginal newborn on the hourly hours of housework and market work of women and their spouses, accounting for the endogeneity of the decision to have a child. The effect on housework hours is of primary interest. There are few estimates of the effect of children on work in the home, as opposed to the labor market, and none has accounted for the potential endogeneity of child timing. This paper takes advantage of a question on housework hours in a large panel survey to estimate the effect of an exogenous child on housework hours, using the birth of a twin as a shock to child spacing.

2.2 Background

2.2.1 Theoretical Basis for Household Time Allocation

Reuben Gronau (1977) provides a theoretical framework for understanding household time adjustments in response to the addition of a child. The model allows individuals to spend time in market work, household work, and leisure. Leisure is something undertaken for its own sake, while work, whether in the home or market, is something one would rather not do and which is at least theoretically substitutable with a market good. Children

change the marginal rate of substitution between leisure and goods as well as shifting the profitability of home production relative to market production of goods.

Thus, there are two decisions following the addition of a child to the household: how much more (or less) to work, and what is the right mix of market and home production. The theory does not offer predictions on the direction of the change in total work hours in response to an additional child. Children might enhance the value of leisure time, causing parents to work less. On the other hand, additional children might increase the utility of goods, whether home-produced goods (such as a cleaner house) or those purchased on the market. In this case, parents would work more. Gronau assumes that an additional child reduces the relative value of leisure, or, in his terminology, that children are goods intensive. The direction of the second effect is clearer. Because children increase the value of the woman's time at home relative to her time in the market, women's work time goes down and time spent in housework increases, at least until children are older and market substitutes for home production are cheaper.

If men and women were equal in all ways, there is no reason that their response to a child would be different on average. However, as Becker (1985) notes, even very small differences in comparative advantage between home and market production can lead to large differences in labor market - and home production - outcomes. If men, for whatever reason, have comparative advantage outside the household, then their response to a child will tend to be

to work more in the market. Depending on the relative profitability of home production, however, they may also increase work in the home.

2.2.2 Empirical Approaches to Estimating Time Use

Estimating the marginal effect of an additional child is difficult because children are likely to be endogenous to the housework hours decision. First, decisions about children and about housework and labor supply hours are likely to be jointly determined. This relates not only to total fertility, but also to the timing of births. It is reasonable to expect that women choose to have children at times when there is a low cost to housework. A related problem is that people with underlying preferences for more children may have different preferences for work in the home versus work in the market.

As a result, simple OLS estimators are likely to be biased and inconsistent. The size and direction of the bias are difficult to determine, because many of the variables that influence housework hours are also correlated with the desire to have a new child. Some intuition can be gained by examining a simple model in which women's change in housework hours in response to a new child is influenced by preferences for a more traditional household with women working primarily in the home, which are unobserved. If this is the only unobserved variable, the correct specification would be:

$$H_W = \alpha_1 + \beta_1 \kappa + \beta_2 \phi + X' \beta_{k+2} + \epsilon$$

where H_W represents women's housework hours, κ is an indicator rep-

resenting the birth of an additional child, X is a vector of personal and household characteristics, and ϕ is the unobserved variable. If ϕ is uncorrelated with other variables influencing housework hours (which is this case is unlikely), leaving ϕ out of an hours equation on the presence of a new child (κ) and other explanatory variables will lead to a bias on the coefficient on κ of:

$$BIAS(\beta_{k^\star}) = \beta_\phi(COV(\kappa, \phi))/VAR(\kappa).$$

The coefficient β_ϕ is positive if women who are more traditional work more hours in the home. The direction of the bias depends on the sign of $COV(\kappa, \phi)$, which should also be positive if more traditional women want a larger family. If women with more traditional households are more efficient in the house, however, then the covariance would be negative. In this case, OLS will overestimate the marginal effect of a child.

There is no empirical evidence on the endogeneity of children to decisions about housework hours. The empirical evidence on whether total fertility is endogenous in the labor supply equation is mixed. Rosenzweig and Wolpin (1980b) compare the results of regressions of a clearly exogenous instrument (the incidence of twins in the first birth) to OLS estimates and find that for children under six OLS substantially underestimates the effect of fertility on women's labor force participation. They take this as evidence that fertility is endogenous. However, Mroz (1987) finds evidence against the endogeneity of children on women's total work hours using U.S. data from the 1975 PSID. His

estimates of the effect of wage on women's market work hours are virtually the same whether children are treated as being endogenous or not. Nonetheless, the theoretical argument remains compelling, and it has become common in the women's labor supply literature to treat fertility as potentially endogenous (Rosenzweig and Wolpin (1980a, 1980b), Angrist and Evans (1998), Jacobsen, Pearce and Rosenbloom (1999)).

One approach to overcoming the endogeneity problem has been to use the incidence of twins as an exogenous shock to fertility. Because the probability a woman has twins over her lifetime increases with the number of births she has, these papers typically use either a twins-ratio instrument or compare the incidence of twins in a given birth, usually the first. Rosenzweig and Wolpin (1980a) use a twins-ratio instrument to test the quality-quantity model of Becker and Lewis, estimating the sign of the effect of a twin on children's education and household expenditures. Bronars and Grogger (1994) apply a twins-first technique to the U.S. Census PUMS, providing many more twins and enabling them to produce more precise estimates of the effect of a marginal child. Gangadharan and Rosenbloom (1996) use the incidence of twins in the first birth in the U.S. Census PUMS to examine the effect of an unexpected child on married women's labor supply, finding that children have a transitory effect on labor force participation, but lasting effects on wages and earnings. Jacobsen, Pearce, and Rosenbloom (1999) reach similar conclusions using a twins-first methodology on the 1970 and 1980 census. Grogger and Bronars (1997) use a twins-first experiment to look at the effect of welfare payments

on the marriage and fertility of unwed mothers.

Another approach is to use child sex ratios as an instrument for fertility. This method relies on families' preferences for a variety of child gender or for children of a given gender. In Mexico and the U.S. , couples who have two girls or two boys as their first two children are more likely to have a third child than couples who have a girl and a boy. Angrist and Evans (1998) use 1980 and 1990 Census data to compare the estimates of the labor supply effects of children obtained by the twins and the children sex ratio instruments. They find that both instruments give an estimate of the reduction of female labor supply which is less than the OLS estimate. Comparing the twins and sex ratio results, they find the difference can be attributed to differences in child age. Lee (2004) uses the sex of the firstborn child in Korea as an instrument to measure the effect of fertility on labor supply outcomes and siblings' educational attainment, relying on a preference for sons.

However, studies of the effect of children on household work hours have not accounted for potential endogeneity. A reasonably large sample is needed for either twins or child gender ratios to be used as a viable instrument. Typically, data sets large enough to allow use of either a twins experiment or a sibling sex ratio instrument do not include information on time spent in the household. It is difficult to find other instruments correlated with the incidence of fertility or a new child but not with other variables influencing housework hours. Available estimates of the effect of a child on housework hours have relied on simple OLS or comparison of means, which are likely to be biased.

2.2.3 Empirical Evidence on Children and Market and Housework Hours

The empirical evidence shows a pattern consistent with the theoretical predictions. The direction of responses is similar across different methodologies, data sets, and countries. Children tend to decrease women's labor force participation and labor hours, but the strength of the effect depends strongly on the child's age. After five years of age, there is little or no effect on women's participation or hours. Angrist and Evans (1998) find that the birth of a third child decreases the probability a woman works. However, these effects, while large and highly significant for young children, were not apparent for children over four years old. Jacobsen, Pearce and Rosenbloom (1999) find that an additional child reduces both weeks worked and hours worked for mothers with children between the ages of 0-2 and 3-5. Women with an additional older child show no reduction in work hours. Numerous other researchers have documented the decrease in women's labor force participation caused by a small child (Jacobsen-Pearce-Rosenbloom (1999), Rosenzweig/Wolpin (1980b), Schultz (1978), Lehrer (1992)). Most studies have found that children have virtually no effect on men's labor supply (Angrist and Evans (1998), Pencavel (1986), Gronau (1976a) Jacobsen et al. 1998)). However, some have found a small positive effect on men's labor supply. Lundberg and Rose (2002) find that children do increase men's wage rate by 4.2% and annual market work by 38 hours. However, they find that most of the effect is in response to the first two children, and that additional children have little effect. Moreover,

hours and wage rates are higher in response to sons rather than daughters.

The available empirical evidence on housework also supports the theoretical predictions. Children tend to increase women's work in the home (a strong positive effect) and decrease market work hours and participation (generally measured more weakly).

Gronau (1977) and Browning (1992) provide a summary of some of the results. The magnitude of the estimates varies considerably depending on the survey type and method used, as shown in Table 2.1. Hunt and Kiker (1984) find that an additional child increases combined housework and child care of a child 0-2 by only 7.8 hours. Hill and Stafford (1980) find that a child 0-2 increases women's child care hours by 7.4 hours and housework hours by 3.3 hours for women with a high school education and 9.3 hours of child care and 7.2 hours of housework for college-educated women. Souza-Poza (2001) finds a child 0-1 years old increases women's housework by 5.9 hours and child care by an additional 12.13 hours. These studies use either OLS or a comparison of means for women with different characteristics. Kooreman and Kapteyn (1984) find a positive effect of a small child on women's housework hours and a negative effect on her leisure hours, but no effect on men's time use. Holmes and Tiefenthaler (1997) point out that the time cost of first children is higher than the cost of later children due to economies of scale, although their estimate of the cost of a first child - 43 hours - is implausibly large.

There is less information on men's housework, and the studies that have been done suggests children have little or no effect on men's housework.

There are some exceptions, however, suggesting that additional small children do increase men's time spent in house care, although not in other types of housework, and not for older children. Souza-Poza (2001) finds that Swiss men provide from 1.4-2.5 extra hours of child care a week for each additional child six and younger, while additional children 14-20 are associated with almost three hours less of housework a week. Hill and Stafford (1980), using the 1975-1976 University of Michigan Time Use Survey, find evidence that college educated men put in 2-2.5 hours of child care weekly for children under 5. Bianchi (2000) cites evidence from the U.S. , Europe and Australia that indicates that men are spending much more time in child care now than several decades ago.

2.3 Methodology

I use a twins experiment to measure the effect of an marginal small child on housework hours. The twins approach is preferable to the sibling sex ratio instrument, since the gender composition of children is likely to itself influence household hours, making it an inappropriate instrument in this case.

I examine the time cost of children between the ages of 0 and 15 months. There are several reasons to look at very young children. The empirical evidence suggests that children have the greatest effect on time use under the age of two, so examining women with children of this age in more detail is worthwhile. Second, considering the effect of children younger than 15 months considerably simplifies the analysis, since parents have not had time to have ad-

ditional children. Additional children would change the amount of time spent with the twin, introducing new questions about economies of scale. While it is easy to adjust coefficients to account for the fact the average fertility of families who have twins converges with time to the average fertility of singleton parents, having twins might influence fertility decisions in other ways. For example, twins are more likely to be of the same sex than two singleton births. I can use children from different birth orders, since the chance of a woman having a twin in a given birth is roughly the same.

In addition, this age range sample is useful because it is a panel and I have information on women before pregnancy. I can provide OLS estimates on the effect of moving from no children to one child. Estimates of the time costs of children taken from cross section data may confound the difference in housework hours of different types of women (those who want fewer or more children) with the actual time cost of the extra child. This is particularly true of cross-section estimates of the time cost of the first child, which rely on comparing women with one child to women who may not even want children. In contrast, panel data allows me to compare the same group of women before pregnancy and after birth. Moreover, I compare them in a relatively short time span, when the relative cost of home production is likely to be similar. Thus, although this estimate is for a selected sample and not the same as the effect if children were randomly distributed among women of childbearing age, the OLS estimate itself has already addressed two sources of bias. Although the sample is still selected, it is representative of women who do have children.

Therefore, the OLS estimate is informative in itself.

The effect I am measuring is the short-term effect of having an additional young child in the family. It is not the effect of higher fertility on housework hours, which would be a long-run effect. Although the twin may be a shock to desired fertility for some women (i.e., those who had wanted only one more child total, and instead had two), for many it is only a shock to child spacing or timing. This does not matter for measurement of the short-run effect.

The first regressions estimate a labor supply equation with weekly housework hours replacing market work hours and additional variables to indicate the birth of a child. The equation is:

$$Hours = \alpha_1 + \gamma_1 Singleton + \gamma_2 Twin + X'\beta + \epsilon$$

where $Hours$ is weekly hours spent in housework and care of others in the family, $Singleton$ is an indicator for the presence of a single child 0-15 months old, and $Twin$ is an indicator for the presence of twins 0-15 months old. The omitted group is women who are not yet pregnant, but who will have child at some point during the survey. The variables that influence women's housework hours included in the vector X are the same as those that influence their work hours. These are age, education, marital status, state of residence, and household variables. I also include specifications with interactions between $Singleton$ and $Twin$ and other variables to test how the impact of other factors

might change after birth.

The estimate of the marginal effect of a twin is obtained by subtracting the coefficient on *Singleton* from the coefficient on *Twin* in the specification with no interacted variables. If having a twin is independent of the other variables which influence household time use, the desired marginal effect would be simply the difference of the means between women with twins and women with singleton births. In fact, having a twin is not completely independent of other factors which could affect time use. The probability of having a twin in a given birth increases both with the mother's age and with the number of children she has had previously. Therefore, mother's age is generally included when twins are used an instrument, even though it might be considered endogenous. Previous studies have not included the number of previous births, although this should be included for the same reason. I also find that the state of residence has some correlation with having a twin in this sample, perhaps because of differences in ethnicity, diet, or infant mortality rates[1]. All reported regressions include indicator variables for state of residence and the year and quarter of the interview. Because there might be concerns that mother's age and the number of previous births are endogenous, alternate regressions without these variables for comparison are run for comparison.

[1]For the twins experiment to be valid, twins need to be distributed randomly regardless of family characteristics. Age and previous births are not random, but can be controlled for. However, twins may also result from fertility treatment, which is correlated with income and other background variables. The effect of spouses' and own income is insignificant once at at the time of birth is controlled for. Twins are also born with lower average birth weight than singletons and may have more medical problems. Because of the way this sample was selected, tins in which one died or was absent any period are not included.

OLS is used for women's housework, men's market hours, and leisure hours. Since many observations contain zero hours for women's work and men's housework, a specification which accounted for this might have been appropriate. I ran several Tobit regressions and found that the results were very similar. Since calculating marginal effects for the Tobit regressions increased the computational difficulty without a clear benefit, I did not use this specification for the reported tables. The dependent variables are hours of housework and market work for individuals. All standard errors are robust and clustered on the household.

2.4 Data

The data are the Mexican government's National Survey of Urban Employment (*Encuesta Nacional de Empleo Urbano*, or ENEU) from 1994 to 1999. This is a quarterly household survey collected by the statistical agency of the Mexican government (*Instituto Nacional de Estatística y Geografía y Informática*, or INEGI) that interviews approximately 100,000 households in 44 urban areas of Mexico every quarter. Urban areas are defined as those with more than 2,500 residents, and the survey provides representation for 65% of Mexico's total urban population. For cities of more than 100,000 persons, 95% of the population is represented. Households are interviewed every three months. Each household should be in the survey five times, for a total of up

to 15 months[2]. Basic demographic and educational information is collected on every member of the household, and more detailed information on every household member twelve years of age and older. In addition to work hours, information on housework hours is included, enabling this analysis. The exact question is, "How many hours did you spend on housework and family care (not for pay) last week?"

2.4.1 Selection of Sample and Twins

The sample consists of women who have a child younger than 15 months of age. Some women give birth during the time frame of the survey, providing observations before the birth and even before the pregnancy. I include women under the age of 50 who have had a child during the period of the survey or just before the survey and their spouses[3]. Husbands are matched to wives through the variables for relationship to household head and marital status. Unmarried women are also included.

The minimum age for a mother is 12 years old, because data on births are not available for younger women. The child must be 15 months or younger, based on an approximation of age. Any periods in which the child is older than 15 months are dropped. I exclude women who have more of their own children in the family than total births (which could indicate miscoding, stepchildren, or adoptions), but keep families who have fewer children in the family than

[2]Some households appear in the data fewer times for unknown reasons. Since the survey tracks households, not families, some families may also be in the survey less than five times.

[3]The age cutoffs exclude only 200 women.

total births.

I identify twins by matching children of the same age, place of birth, and relationship to the household head. I include only children who have been in the sample for at least two periods or who are observed entering the household at the same time to avoid misidentifying closely-spaced children as twins. Only the youngest child is considered. In families with two children less than fifteen months of age, the younger child is considered the new child.

The data set provides the age of the child in years, but not in months. Therefore, the age in months is approximated by using quarters. Children who are in the survey five quarters are taken as "15-month olds", although the actual age range of these children is 12-18 months.

Many women with children in Mexico live in extended families. In these families, the family patriarch or matriarch is usually listed as the head of household. When there is more than one wife/husband couple in the household, parents and children are matched by their relationship to household head and the proximity of the observations where possible. Households where it is not possible to assign one or more spouse or child correctly are excluded.

2.5 Descriptive Statistics

The sample of women contains 125,534 observations on 47,847 women who have recently given birth to a singleton and 1,017 observations on 390

women who have recently given birth to twins[4]. There are 110,548 observations on 42,556 spouses of recent mothers, including 905 observations on 347 recent fathers of twins. In addition, the data set provides 2,359 observations on women before pregnancy and 28,835 observations on women during pregnancy.

Tables 2.2 and 2.3 give descriptive statistics for parents of singletons vs. parents of twins. Mothers of twins are on average about 1.8 years older than mothers of singletons. Other differences are probably due to the difference in age. For example, twin mothers have .26 more children before having twins. They also have slightly higher household income and husband income, but lower own income.

Educational levels are similar — about 8 years of education for each group. About 88% of all women have a male partner in the house. The percent of married women is 77% for non-twin mothers and 79% for twin mothers. In addition, 12.6% of non-twin mothers and 11.5% of twin mothers are in common-law marriages.

Some 13% of non-twin mothers live with their parents, and 8.4% live with the husband's parents. An additional 1.4% live with other relations or nonrelatives. The rest are either the head of household or the spouse of the household head. The figures for twin mothers are 10.1% in their parents' home, 6.4% in the husbands' parents', and 1.7% in other relatives' houses.

[4]The percentage of twins in the sample is .8, or one twin birth for about 125 singleton births. For comparison, the twinning rate of whites in the U.S. is 1-1.2%.

2.5.1 Descriptive Statistics by Birth Period

For women who have a new child during the survey, I have additional observations before the birth took place, and, in cases where the woman is in the sample five times and the new child is observed only in the last quarter, even before pregnancy. I have data on 2,338 non-twin mothers before pregnancy, 14,407 during pregnancy, and 47,847 after birth. For twin mothers, I have information on 21 women before pregnancy, 142 during pregnancy, and 390 after pregnancy[5].

Table 2.4 divides the sample into periods according to whether women are not yet pregnant, are currently pregnant, or have already given birth. The table includes only women who are in the sample 5 quarters so that the groups are comparable[6].

During pregnancy, total weekly hours drop by about two hours, from 51.72 hours to 49.7 hours. Housework hours go up slightly: mothers work 38.01 hours in the home before pregnancy and 38.92 hours during pregnancy. Market work hours decrease from 13.51 hours to 10.85 hours on average. Participation (measured as "being employed," not on the basis of hours) decreases from 37% in pre-pregnancy to 31% during pregnancy. For women who continue working, average work hours are only about half an hour less.

After birth, average housework hours for non-twin mothers increase by

[5]All women are observed in at least one period after pregnancy.

[6]Otherwise, pre-pregnant women, who must be in the sample 5 periods to be identified, appear older tan women who are pregnant, who may be in the sample 2-5 times.

about 4 hours from pregnancy to 42.8 hours. Total work hours increase by 3 hours. Labor force participation again drops (but only by about 2 percentage points). For those who work, however, average work hours decrease by only about .4 hours. Total housework hours increase by 4.3 hours, indicating that the mother herself bears most of the burden of extra work in the home.

After giving birth, twin mothers have 46.5 hours of average housework, 3.1 hours more than singleton mothers. They have .35 hours less market work. Average total hours for mothers of twins are 2.7 hours more than for mothers of singletons.

The equivalent figures for men are presented in Table 2.5. Men's housework hours are much lower than women's and their market hours are higher, evidence of specialization. Spouses contribute on average 6.55 hours a week of housework and 45.8 hours of market work in the pre-pregnancy stage.

2.5.2 Descriptive Statistics by Number of Children

The data show large differences between women with different family sizes. Women with more children are older, reflecting both that women need time to have more children and cohort effects. Education drops from an average of 8.6 years for women who are having their first child to 4 years to women who have 8 or more previous children. Women with more children seem more traditional in other ways as well. Fewer of them work, and when they do work they work fewer hours. It is not clear to what extent these differences are due to changes in relative costs of being at home versus being in the market, to

tastes about different lifestyles, or to cohort effects (older women had fewer educational and work opportunities).

Chart 2.1 shows the pre-birth housework hours for all mothers. Hours of weekly housework before the birth are increasing in the number of children. The largest difference is between having 0 and 1 child, which changes the housework by almost 10 hours per week. The time spent in the house with an additional child rises more slowly as the total number of children increases, and after there is little effect for families with five or more children.

Work hours after birth are shown in the uppermost line. The average time cost of the extra child is represented by the difference between the two lines. An additional newborn increases the average woman's housework hours less for families with more children. For families with more than four children, an additional newborn seems to have no effect at all in terms of increased work time for the woman.

The line on the bottom shows the difference between housework hours for a mother who has given birth to twins and a mother who has given birth to a singleton. Thus, it represents the time cost of an unexpected child by number of previous children, not accounting for other factors. Having a twin in the first two births increases time spent in the household, but by less than a factor of two. A second twin born as the third child increases housework less than a second twin born as the second child. However, for twins born in the third and fourth pregnancy, the additional time per child is more for twins than for a singleton. For families with more children, the number of mothers

with twins is too small for a meaningful analysis.

2.6 Regression Results

2.6.1 Women's Housework Hours

Table 2.6 reports regression results for women's housework, market work, and leisure time. Women may change their time use patterns during pregnancy, so only observations before pregnancy and after birth are included. The basic specification includes indicator variables for singleton and twin, educational and marital status, whether the husband and wife are the heads of the household or live with parents or other relatives, and the number of other people in the household.

A singleton birth increases women's hours of housework by 5.0 hour a week. Almost all of this comes from work hours, which are reduced by 4.2 hours a week. However, leisure time, defined as total time minus market work and housework, also goes down by .8 hours a week.

The coefficient on twin indicates a smaller adjustment to housework and work hours in response to a second child. The increase in housework for the marginal child is the coefficient on $Twin$ minus the coefficient on $Singleton$, or -3.2 additional hours per week, only 63% of the time adjustment to the first child. It is not possible to tell how much of this difference is due to accounting for endogeneity, how much to economies of scale, and how much to decreasing returns to housework in raising children. The work reduction for a twin is also less, only 2.0 hours or 46% of the OLS effect. Leisure hours, however, drop

even more — by 1.2 hours.

I also run additional unreported specifications which leave out all variables except for the mother's age, number of previous births, and twin and singleton, which include only the mother's age, and which include interacted variables. The estimates for the additional cost of a twin in the other specifications are similar, ranging from 3.2–3.5 hours more of housework, 2.0–2.2 hours less work, and 1.2–1.3 fewer hours of leisure.

Age is associated with a decrease in housework hours when the number of previous children is accounted for. After the age of 38, market work hours are decreasing for women, which could be either because household income is higher or because of cohort effects. Leisure is decreasing with age until age 35.

Education also matters in the expected way. Women with less than a high school education do from 3.2–3.3 hours more housework a week than women with a high school education, while women with a college education do 1.5 hours less housework a week. Theory predicts that women with more education will increase housework hours less for an additional child than those with less education, since staying at home is more costly for them. However, the interacted variables show the opposite result. Although less educated women do more housework than those with at least a high school education, they increase their housework hours less after the birth of a child. This is in line with other research looking at disaggregated time use that has found that more educated women do less housework but spend more time in child care. Angrist and Evans found a similar result: women with more education

have a stronger labor force reduction in response to an additional child. One explanation for this may be that educated women value education more for their children and see parental time inputs as an important part of a child's education. Another way to look at this is that education could increase the value of women's time spent with children even more than it raises their market productivity. Also, it may be that women equate their marginal utility instead of the marginal products of work and home production, and that staying at home with a small child is a normal good.

Being single is associated with the largest drop in household hours: single women do 10.2–10.7 hours less housework a week than married women, and divorced and separated women do 8.7–9.3 hours less. Both single and divorced women also do more market work more than married women. However, single women have 4 hours more leisure in addition, while divorced women increase their market hours by more than they reduce housework hours. Both single and divorced women increase housework hours and reduce housework hours more in response to the birth of a child. Women in common-law marriages (*unión libre*) do not spend more time in housework than married women when the number of children is controlled for, but they work more in the market and have less leisure.

Women who do live with their own parents, and to some extent, with other relatives, do less housework. However, the unreported interacted specification indicates that there is no significant difference in hours for these women before they have their child. It must be kept in mind that some women move

into their parents' house shortly before or after giving birth, so that the group of women living with their parents after birth may be different from the group living with their parents before becoming pregnant.

The presence of an additional woman older than 18 decreases weekly housework hours by about an hour and a half a week. The presence of additional women 12-18 has little effect on housework hours when the number of previous children are accounted for. The reduction in housework associated with having additional women in the household is more than made up by increased average market work hours. Women with other women over 18 years old in the household work 2.7-3.7 hours more in the market before birth, and about an hour more after birth.

2.6.2 Men's Time Use Response

The regressions of men's average hours, which are reported in Table 2.8, support the previous evidence that the birth of a child has little impact on fathers' time use, but indicate that men do help out for an additional second child. Men's housework, market work, and leisure are unaffected by the birth of a singleton. However, men increase housework by 1.2 hours after the birth of a twin.

Men with less education contribute less housework and work more in the market, suggesting a backward-bending labor supply for market work. There is no special effect of education to the care of a child.

Other aspects of family composition are also not very relevant. Other

individuals in the household reduce men's housework, and having more older women or adult men in the household is associated with reduced work hours and increased leisure. Men who are living with their own parents do both less housework and less market work, perhaps because men without jobs or who work few hours are less likely to be able to afford their own home. Each additional previous child in the family reduces men's housework by only about 14 minutes a week. However, the extra time is not devoted to market work, but to leisure — 10 extra minutes a week.

2.6.3 Interpreting Results

The twins experiment provides an estimate of the time cost of a child that is exogenous to decisions about time use in the home. However, it is not the estimate that is of most interest, the expected time cost of a single newborn regardless of the age of siblings. There are several important differences between a twin and a singleton birth. The twin has a sibling of the same age, while the singleton cannot have siblings less than 15 months older, and may have no older siblings. Moreover, the twin, although unplanned, was born at a time when the parents were likely to have had particularly low costs to home production .

How does the twins estimate of the cost of a child compare with the cost of a child born in a more common birth spacing, at some time a year of more after her sibling? If there are economies of scale to taking care of children of the same age and sex, the twins might take less time, and the marginal effect

of the twin child could be interpreted as the lower bound for the effect of an exogenous second young child. However, because older children take less care, the combination of the infant and 1 year old might take less time, in which case the marginal effect of the twin would be a higher than the estimate of an exogenous non-twin birth.

Even if the coefficient on twins is taken as the lower bound of the effect of an unplanned child to a mother who already had a small child, the estimates seem rather low compared to previous estimates. The marginal effect of a twin, 3.5 hours a week, is far below the estimates of 12 hours or more that some researchers have found, or what many people might intuitively guess. Even the OLS coefficient on a single birth, 4.6 hours a week, is lower than estimates from other studies. Some of the difference has to do with the way housework is measured. Because the question asks about aggregate housework, rather than child care and housework individually, joint activities are not double-counted. A large amount of substitution between housework activities could mean that child care took much more than the estimated amount, but that time spent in other housekeeping tasks went down as well. This in itself is an interesting question. If the quality of other home production is decreased, this is another aspect of the cost of the child. Particularly, it is important to know if additional children take time away from child care provided to previous siblings.

It is also worth noting that total hours worked in the home is only one dimension of the effect having a child may have on work participation and

hours. Other researchers have hypothesized that caring for children may be more effort-intensive than other types of work. The scheduling of child-care is important in addition to total hours. Young children demand attention at inflexible periods and also on an unpredictable schedule. This can make any work which must be scheduled even a few hours in advance difficult .

2.7 Concerns with Recall Data

Recall data are less accurate than time diary data. Juster and Stafford (1991) discuss this problem in detail in their review of time-use data. In tests, estimates from recall data were 25% higher for household chores and 3 times higher for child care, compared to time-diary estimates. This could be because child care is especially effort-intensive and thus people remember doing it more, or because child care is likely to be a joint activity. This problem is mitigated by the fact that I use total hours of housework, not the hours for a specific activity, so I do not have a problem with over-reporting due to counting joint activities twice. If additional housework hours are systematically over-reported by some set percent, the level estimates will be biased up, but the percent change in housework will not be. However, if child care is systematically over-reported and other housework is not, and time is substituted form housework to child care, the estimates in the change will be biased.

A related problem is that people tend to estimate both housework and work hours with approximations. This will increase standard errors, but will not change the expected value of the estimated effects unless there is systematic

under- or over-reporting.

Many observations are reported by other members of the household. If these data are reported with error, it will lead to unreliable standard errors. Worse, if they are systematically underreported, the level estimates will be biased downward. This is more of a problem for working women and for men[7]. As a comparison, I also ran regressions using only those observations for which data have been supplied by the women herself for nonworking women. The average hours of housework are higher for those who are report their own hours (as expected). However, compared to all nonworking women, the coefficient on $Twin$ is only slightly higher. If women underestimate the additional hours that men contribute to housework when a child is born, this could lead to an underestimate of the hours of men.

2.8 Conclusions

This study has used the birth of twins as a natural experiment to measure the effect of a marginal child on household time use. This is the first research to address the effect of a child on housework hours accounting for the endogeneity of children. The estimate for women's time use of 3.5 hours may be interpreted as the lower bound on the expected increase in household hours for a woman who already has a small child and unexpectedly

[7]Among nonworking women in my sample, 68.4% of observations are self-reported, while among women who work the figure is 56.5%. The figures for self-reporting are 20.3%-33.5% for men.

has another. Accepting this as a lower-bound estimate, however, requires making assumptions about the direction of the bias and the economies of scale of small children.

Overall, the effect of an additional child is relatively small - the twins estimate is a 8.3% increase over hours worked in the home before pregnancy. Even the OLS estimates are relatively small, showing about a 13% increase in women's housework hours. A new child generates a smaller reduction on women's work than the increase in her housework, and a negative effect on women's leisure. I find no overall effect of children on men's work and leisure, although there is an increase of 1.1 hours a week for housework hours in response to the birth of twins.

The size of these estimates might indicate that families are flexible with how they use their time in the house, and that, while women's leisure time is reduced by the birth of a child, additional housework hours may not be the main impact of children on women's welfare and labor supply decisions. Other aspects, such as the need to be "on-call" for children at all times, a higher intensity of effort, or scheduling problems in combining child care with activities outside the home, may play an important role.

Table 2.1: Empirical Evidence: Effect of a Young Child on Women's Housework

Researcher	Data Year	Age of Child	Hrs/Week	
Hill & Stafford (1980)	1975	child 0-2	10.7	Woman w/. HS
		child 0-3	16.5	Woman w/. College
Hunt & Kiker (1984)	1978	child 0-2	7.8	Nonworking Women
	PSID	child 0-3	7.7	Working Women
Balls (1980)*	1 yr.old	12.5		
		2 yr. old	7	
Souza-Poza (2001)	1997	child 0-1	18.03	Swiss data
		child 1-2	13.43	
Gronau (1977)	1972	child before school	6.28	Nonworking Women
		child before school	5.33	Working Women
Robinson (1987)	1967-8	child<1	21	Nonworking Women
Leibowitz (1974)	1967	child<1	13.48	
Anxo & Carlin (2002)	1998	children 0-3		NS French data
Alvarez & Miles (2002)	1991	children 0-3	5.34	Spanish data
Miller & Mulver (2000)		child 0-1	19.33	Australian data
Lindert (1978)**		1st 1 year old	19.8	
		3rd 1 year old	5.85	
Turchi (1975)**		1st child<2	14	
		add. child<2	6.60	
Gustafsson & Kjulin**		1st child< 1	11.40	Swedish data
Tiefenthaler (1997)	1983	1st 1 yr. old	43.00	
		2nd child, 1 yr.	13.02	
		3rd child, 1 yr.	7.22	

**cited in Browning **cited in Tiefenthaler (1997)*

Table 2.2: Variable Means by Twin Status

	Women		Men	
	Nontwin	*Twin*	*Nontwin*	*Twin*
Ind. Obs.	47,847	390	42,556	347
Total Obs.	156,427	1,310	137,436	1,159
Variable				
Age	26.62	28.35	29.66	31.31
	(5.84)	(5.80)	(6.88)	(6.80)
Education	7.87	7.86	8.79	8.68
	(3.18)	(3.17)	(3.25)	(3.44)
Married	0.77	0.80	0.86	0.87
	(0.42)	(0.40)	(0.35)	(0.33)
Single	0.07	0.04	0.00	0.00
	(0.26)	(0.20)	(0.03)	(0.04)
Divorced	0.03	0.05	0.00	0.00
	(0.17)	(0.21)	(0.01)	(0.03)
Common-Law	0.13	0.12	0.14	0.12
	(0.33)	(0.32)	(0.35)	(0.33)
Father's Fam.	0.08	0.06	0.06	0.05
	(0.28)	(0.25)	(0.24)	(0.22)
Mother's Fam.	0.13	0.10	0.09	0.07
	(0.34)	(0.30)	(0.29)	(0.26)
Other Rel.	0.01	0.02	0.01	0.01
	(0.12)	(0.13)	(0.09)	(0.11)

Table 2.3: Variable Means by Twin Status

	Variable Nontwin HH	*Twin HH*
No. Births	2.08	3.16
	(1.49)	(1.96)
No. Prev. Children	1.20	1.47
	(1.31)	(1.53)
Has Spouse	0.88	0.88
	(0.33)	(0.32)
Other Women 12-18	0.15	0.19
	(0.44)	(0.50)
Other Women 19-59	0.28	0.20
	(0.63)	(0.55)
Other Women>59	0.13	0.07
	(0.35)	(0.27)
Other Men 12-18	0.15	0.18
	(0.44)	(0.50)
Other Men 19-59	0.24	0.18
	(0.60)	(0.53)
Other Men>59	0.10	0.07
	(0.31)	(0.27)
Own Income*	153.51	152.19
	(356.22)	(329.81)
Spouse Income*	618.69	674.18
	(766.65)	(789.30)
HH Income*	852.21	855.42
	(1077.22)	(905.10)

**Monthly income in 1990 pesos*

Table 2.4: Variable Means by Birth Period, Women

	Prepregnancy	Pregnancy	After Birth	
	All	*All*	*Nontwin*	*Twin*
No. Ind.	2,359	14,549	47,847	390
No. Obs.	2,359	28,835	125,528	1,017
Housework, Hrs/Wk.	38.00	38.59	42.87	46.42
	(17.21)	(16.52)	(17.20)	(18.66)
Work Hrs./Wk.	13.73	10.59	9.64	7.93
	(20.20)	(18.53)	(18.01)	(16.64)
Work Hrs (Workers)	37.56	37.49	37.11	37.01
	(14.85)	(14.38)	(15.13)	(14.64)
Leisure Hrs/Wk.	153.91	157.11	158.08	159.84
	(20.59)	(18.90)	(18.37)	(16.98)
Total Hrs/Wk.	51.72	49.18	52.50	54.35
	(19.58)	(18.65)	(18.30)	(18.79)
HH Housework Hrs/Wk.	61.98	62.86	67.47	67.86
	(34.79)	(35.62)	(36.80)	(35.72)
Employed	0.37	0.30	0.28	0.23
	(0.48)	(0.46)	(0.45)	(0.42)
Pos. Work Hrs	0.37	0.28	0.26	0.21
	(0.48)	(0.45)	(0.44)	(0.41)

Table 2.5: Variable Means by Birth Period, Spouses

	Prepregnancy	Pregnancy	After Birth	
	All Spouses	*All Spouses*	*Nontwin*	*Twin*
No. Ind.	2,029	12,822	42,556	347
No. Obs.	2,029	25,137	110,515	904
Housework, Hrs/Wk.	6.53	6.22	6.69	7.30
	(8.51)	(8.10)	(8.59)	(8.98)
Work, Hrs./Wk.	45.81	45.67	45.72	44.45
	(17.95)	(18.11)	(18.23)	(17.60)
Work Hrs (Workers)	49.08	48.88	49.03	48.12
	(13.60)	(13.93)	(13.93)	(12.59)
Leisure, Hrs/Wk.	121.22	121.37	121.32	122.59
	(18.04)	(18.19)	(18.32)	(17.70)
Total Hours/Wk.	52.34	51.89	52.41	51.76
	(18.65)	(18.89)	(19.13)	(19.18)
HH Housework, Hrs/Wk.	59.40	60.53	65.44	69.05
	(33.07)	(34.13)	(35.23)	(35.52)
Employed	0.97	0.97	0.96	0.96
	(0.18)	(0.18)	(0.18)	(0.20)
Positive Work Hrs	0.93	0.93	0.93	0.92
	(0.25)	(0.25)	(0.25)	(0.27)

Table 2.6: Effect of Marginal Child on Women's Time Use, Hrs/Wk.

	Housework		Mkt. Work		Leisure	
Singleton	5.019	(0.317)***	-4.236	(0.406)***	-0.784	(0.393)**
Twin	8.179	(0.730)***	-6.191	(0.872)***	-1.989	(0.785)**
Age	-0.28	(0.079)***	1.786	(0.103)***	-1.505	(0.087)***
Age Sq.	0.002	(0.001)	-0.023	(0.002)***	0.021	(0.002)***
None/Elem.	3.154	(0.157)***	-2.959	(0.207)***	-0.196	(0.169)
Jr. High	3.336	(0.164)***	-3.087	(0.216)***	-0.248	(0.179)
College	-1.543	(0.327)***	-1.424	(0.404)***	2.967	(0.382)***
Single	-9.503	(0.273)***	13.261	(0.402)***	-3.769	(0.331)***
Divorced	-7.835	(0.300)***	12.042	(0.473)***	-4.217	(0.356)***
Common Law	-0.338	(0.161)**	0.543	(0.213)**	-0.209	(0.179)
Spouse's Fam.	0.119	(0.284)	-2.037	(0.368)***	1.92	(0.316)***
w/Own Fam.	-2.691	(0.284)***	0.532	(0.385)	2.161	(0.311)***
w/Other Rel.	-0.868	(0.484)*	-0.776	(0.668)	1.65	(0.534)***
HH Women 12-18	-1.292	(0.129)***	1.289	(0.173)***	0.003	(0.142)
HH Women 19-59	-1.259	(0.113)***	1.154	(0.150)***	0.106	(0.124)
HH Women>59	-1.773	(0.202)***	2.102	(0.267)***	-0.324	(0.220)
HH Men 12-18	-0.246	(0.133)*	0.409	(0.180)**	-0.156	(0.150)
HH Men 19-59	-0.059	(0.113)	-0.472	(0.154)***	0.528	(0.127)***
HH Men>59	0.531	(0.228)**	-0.954	(0.306)***	0.416	(0.252)*
Prev. Children	1.711	(0.055)***	-1.556	(0.072)***	-0.152	(0.061)**
Constant	46.923	(1.221)***	-18.205	(1.551)***	-4.734	(1.352)***
Obs.	128,901		128,908		128,895	
R-squared	0.16		0.1		0.08	

Regressions include state of residence, quarter, and year.

Table 2.7: Effect of Marginal Child on Men's Time Use, Hrs/Wk.

	Housework		Market Work		Leisure	
Singleton	0.203	(0.178)	-0.055	(0.401)	-0.149	(0.411)
Twin	1.212	(0.363)***	-1.109	(0.803)	-0.109	(0.857)
Age	-0.021	(0.024)	0.192	(0.079)**	-0.172	(0.078)**
Age Sq.	0	(0.000)	-0.004	(0.001)***	0.004	(0.001)***
Spouse Age	0.055	(0.040)	0.071	(0.118)	-0.125	(0.117)
Sp. Age Sq.	-0.001	(0.001)	-0.003	(0.002)	0.003	(0.002)*
None/Elem.	-0.393	(0.072)***	0.096	(0.189)	0.295	(0.189)
Jr. High	-0.26	(0.072)***	1.421	(0.184)***	-1.16	(0.184)***
College	0.21	(0.125)*	-3.469	(0.328)***	3.259	(0.328)***
Common Law	-0.222	(0.078)***	-0.358	(0.226)	0.581	(0.222)***
Spouse Fam.	-0.28	(0.148)*	-0.952	(0.388)**	1.228	(0.387)***
Own Fam.	-0.322	(0.143)**	-4.067	(0.400)***	4.384	(0.400)***
w/Other Rel.	-0.485	(0.279)*	-0.643	(0.838)	1.126	(0.828)
Women 12-18	-0.363	(0.066)***	0.38	(0.197)*	-0.018	(0.196)
Women 19-59	-0.43	(0.063)***	0.248	(0.177)	0.179	(0.175)
Women 60+	-0.515	(0.102)***	-0.524	(0.286)*	1.038	(0.283)***
Men 12-18	-0.206	(0.066)***	-0.415	(0.187)**	0.621	(0.186)***
Men 19-59	-0.169	(0.057)***	-0.274	(0.158)*	0.45	(0.156)***
Men 60+	-0.213	(0.111)*	0.512	(0.326)	-0.3	(0.322)
Prev. Child.	-0.239	(0.027)***	0.118	(0.074)	0.121	(0.074)
Constant	6.49	(0.632)***	42.076	(1.770)***	-24.583	(1.765)***
Obs.	113,327		113,292		113,291	
R-squared	0.11		0.02		0.05	

Regressions include state of residence, quarter, and year.

Table 2.8: Women's Hours by Number of Previous Children

	Women's Housework					
	No Prev.		One Prev.		Two Prev.	
Singleton	9.175	(0.551)***	4.911	(0.537)***	2.469	(0.668)***
Twin	12.578	(1.321)***	7.461	(1.164)***	6.382	(1.730)***
None/Elem.	2.198	(0.242)***	3.495	(0.272)***	4.14	(0.366)***
Jr. High	2.454	(0.249)***	3.463	(0.284)***	4.472	(0.391)***
College	-3.113	(0.454)***	-0.254	(0.572)	0.095	(0.881)
	Women's Market Work					
	No Prev.		One Prev.		Two Prev.	
Singleton	-5.222	(0.837)***	-4.444	(0.670)***	-4.397	(0.802)***
Twin	-8.259	(1.700)***	-5.164	(1.518)***	-6.7	(1.513)***
None/Elem.	-1.866	(0.329)***	-3.437	(0.351)***	-3.689	(0.470)***
Jr. High	-1.712	(0.336)***	-3.681	(0.370)***	-4.098	(0.503)***
College	-2.541	(0.565)***	-0.052	-0.718	0.202	-1.049
	Men's Housework					
	No Prev.		One Prev.		Two Prev.	
Singleton	1.242	(0.333)***	-0.01	-0.302	-0.347	-0.386
Twin	1.774	(0.727)**	0.178	-0.555	2.145	(0.862)**
None/Elem.	-0.524	(0.125)***	-0.572	(0.128)***	-0.118	(0.159)
Jr. High	-0.26	(0.117)**	-0.417	(0.125)***	-0.061	(0.163)
College	0.318	(0.206)	0.106	(0.214)	0.216	(0.266)
	Men's Market Work					
	No Prev.		One Prev.		Two Prev.	
Singleton	-1.045	-0.778	0.704	-0.673	0.88	-0.810
Twin	-2.854	(1.632)*	0.246	(1.220)	-0.977	(1.804)
None/Elem.	1.349	(0.327)***	-0.243	(0.319)	-0.14	(0.411)
Jr. High	1.95	(0.300)***	1.05	(0.305)***	1.041	(0.430)**
College	-5.575	(0.545)***	-2.719	(0.524)***	-1.544	(0.730)**

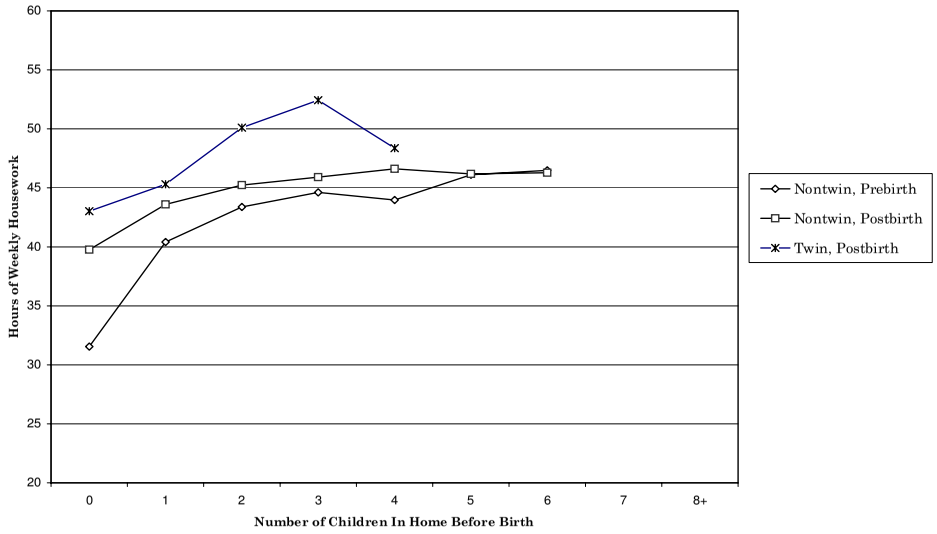

Figure 2.1: Housework Hours Before and After Birth by Number of Previous Children

Chapter 3

Helping the Family Immigrant English Skills and Self-Employment

3.1 Introduction

Self-employment has been seen in the American national mythos as a means for hard-working immigrants to pull themselves up in spite of disadvantage. Popular culture contains many fond references to immigrant-owned small business, from Apu in *The Simpsons* to *Seinfeld's* Soup Nazi. In fact, immigrants from Europe and Asia do have higher rates of self-employment than native-born Americans, although the difference has narrowed in recent decades. The rates are particularly high when compared to nonimmigrant groups that might be considered disadvantaged in similar ways.

Sociologists and, to a lesser extent, economists have advanced many theories to explain immigrants' higher self-employment rates. One branch of the literature hypothesizes that immigrants have a special advantage in self-employment, such as better entrepreneurial skills or a preference for self-employment (Light (2000), Yuengert (1989)), a comparative advantage in serving niche markets (Borjas (1986), Aldrich and Waldinger (1990)), or access to credit and information through social networks (Light (2000), Aldrich and

Waldinger (1990). An overview of these theories is found in Fairlie and Meyer (1994). Alternatively, immigrants might have some disadvantage in wage employment that they do not have in self-employment. Glazer and Moynihan (1970) suggest that self-employment is a means of social advancement for groups facing discrimination. Immigrants have less education on average and are less familiar with the system and culture. They may face discrimination (Bronars and Borjas (1989)) or have difficulties with their legal standing. The difficulty is in identifying factors which have differential returns in wage labor than in self-employment. Social networks provide opportunities for self-employment, but also for wage employment, and often arise to address an underlying disadvantage. The disadvantages faced by immigrants would also seem to hurt them in self-employment. It is not clear ex-ante why these factors would encourage self-employment.

Another disadvantage for many immigrants in the U.S. is a poor set of English skills. Workers who speak English poorly cannot communicate clearly with supervisors and customers. This reduces their productivity, and hurts them in negotiating for higher salary or better benefits. They may be less informed about new opportunities, employee services, and workers' rights. However, poor language skills also pose problems in self-employment. Since most immigrant businesses serve primarily clients outside of their owners' ethnic groups, communication in English is important. In addition to dealing with customers and clients, someone who is self-employed must also be able to deal with bureaucratic red-tape and negotiate for credit and contracts.

An immigrant with poor language skills would be better off if she could enter a partnership with someone who spoke both her own language and English. The poor speaker could then specialize in tasks not requiring language skills, letting the better speaker handle aspects of the job requiring communication in English. Unlike wage employment, which creates jobs and then seeks workers to fit them, two workers who organize their own business can tailor tasks to suit the abilities of each. As long as the total business profit is at least the same as total of the wages the workers would receive in wage employment, some arrangement can be worked out so that the workers are indifferent between the two choices.

The family unit provides a natural basis for the development of such contracts. On the most basic level, it provides a pool of people who speak the same language and know each other. The family has detailed information on the abilities of its members that is unavailable to employers, which reduces monitoring costs. It also has access to nonmonetary threats and incentives. Trust may intrinsically be greater between family members than between employees and employers. Finally, if families are altruistic and share income, then other family members have a direct interest in maximizing the total income of the family, not just their own wages.

The motivation for this type of collaboration is the presence of the opportunity for trade among family members in their language skills. If productive family members can all do as well individually in the labor market as they can together, there is no incentive for them to open a business. If

everyone in the family is disadvantaged, there is no reason self-employment income would be higher than wages for anyone. Thus, I expect to find that the greater the dispersion of English skills in the household, the greater the likelihood of self-employment.

The result of such a family-based collaboration could be a family business. In this case, both good English speakers and poor English speakers would be more likely to be self-employed if there was a spread of English skills in the household. However, the arrangement could be more informal. Household members who speak English well could provide advice to self-employed relatives who speak English poorly. Those who speak English poorly could be hired as employees or help out informally in a business operated by a family member speaking English well. In this case, the range of English skills in the family will still be important for the possibility that any one family member is self-employed, but it might not increase the chances of self-employment for family members of all language abilities.

Understanding how language skills influence immigrants' labor decisions might help develop policies to help them assimilate. Many local and state governments see self-employment initiatives as a means to address unemployment and poverty, and might want to increase self-employment among immigrant groups. On the employment side, it makes sense to help small businesses more if they are employing people who otherwise would be underemployed or unemployed. Finally, understanding the family context of the self-employment decision might provide some insight into how families inter-

act and help each other, and indicate special vulnerabilities for individuals who do not have such family support.

3.2 Background

The U.S. remains a country of immigrants. In March 2000, 28.4 million Americans were foreign-born, or 10.4% of the population. Both the total number of immigrants and the percentage of immigrants has been increasing since 1970, and currently is at its highest level since the 1930's. In all, immigrants make up 12.4% of the U.S. labor force.

Self-employment has historically been an important source of work for immigrants. From 1910 through the 1950's, immigrant self-employment rose slightly as native self-employment rates went down, reaching a high of 18.1% in the 1940 Census and 17.6% in the 1950 Census (Chart 3.1). The self-employment rate of native-born Americans in the same two Censuses was 12.6% and 11.4%, respectively. In recent decades the level of immigrant self-employment has been closer to that of natives. Immigrant self-employment dropped sharply in the 1960 and 1970 Censuses. After 1980, both immigrant and native self-employment grew slightly, ranging from 8–10%. In 2000, the self-employment rate is only slightly higher for immigrants.

Some of the decrease in immigrant self-employment is probably due to changes in demographic composition. Immigrants to the U.S. in the 1930's, 40's and 50's came primarily from Europe and were highly educated. In the last three decades, immigrants from Mexico and Central America, who tend to

have less education and less experience in the U.S. and may plan on returning to their home countries, have far outnumbered immigrants from other regions. As Chart 3.1 shows, self-employment for Mexican and Central immigrants to the U.S. is lower than self-employment for other immigrant groups, and lower than the self-employment of native-born Americans. When Central Americans are excluded from the sample, the group of all other immigrants are about 2.2% more likely to be self-employed than American natives. Some groups have much higher self-employment rates. Workers 25-60 years old born in Korea have a self-employment rate of 25.5%, those from the Middle East 21.5%, from Greece 25%, and from Israel/Palestine 24.8% (Table 3.1).

3.2.1 Immigrant English Skills and Employment

Both immigrant self-employment and the effect of English skills on immigrant wages have been extensively studied on their own. There is wide agreement that individual English skills are important to immigrants' economic outcomes. Carliner (1996) finds that the wage effect of improving one's English from one level to another on a scale of five in the U.S. Census (for example, moving from speaking no English to speaking poor English or from speaking English well to speaking English very well) is the same as the return to an additional year of education. Chiswick and Miller (2002) find that fluent English has a return of 14% for immigrants, controlling for selection of those with more ability. The negative effect of speaking English poorly is highest for those with more education in both studies. Berman and Lang (2003) find that

improvements in Hebrew skills can explain 67-75% of the increase in wages for skilled Russian-speaking workers in Israel. Others have found that immigrants to the UK who speak English more fluently select into higher-paying occupations (Price and Shields (2002)), that immigrants who speak the prevalent language poorly have lower wages (Price and Shields (2002), Dustman and Fabbri (2000)), and that immigrants who speak the dominant language poorly tend to be concentrate in immigrant enclaves where there are lower returns to English (McManus (1990)). Moreover, it is generally found that immigrants with poor language skills are more likely to be unemployed and more likely not to participate in the labor market (Chiswick and Miller (2002), Dustman and Fabbri (2000)).

Less work has been done on the effect of English skills on self-employment. Lofstrom (2002), in a study of assimilation and self-employment, includes speaking no or poor English as a control variable in his regressions, and obtains a negative coefficient. No studies have looked at the language skills of others in the household, whether in relation to self-employment or other outcomes.

However, much work has been done on the importance of immigrant enclaves, which may be relevant. An enclave, like a family, is a social network, although on a much larger scale. In the literature, enclaves are usually defined by ethnicity, Evans (1989) uses a linguistic basis for defining the enclave. The expected effect of an enclave on self-employment probabilities is not clear. Some researchers have hypothesized that larger enclaves offer larger specialized markets which immigrant entrepreneurs can take advantage of (Borjas (1986),

Aldrich and Waldinger (1990)). Immigrant entrepreneurs also have special access to low-priced immigrant labor in an enclave. Reduced employer and customer discrimination may also make it easier to enter self-employment. However, if it is also easier to find a job in an enclave, then self-employment may be lower. It is also difficult to predict which effect differential access to credit in enclaves should have on self-employment. On the one hand, the presence of many co-ethnics may make credit easier to obtain; on the other, there are likely to be fewer formal banks and a lower average income level in an immigrant enclave.

Not surprisingly, the empirical results are mixed and location-specific. Borjas (1986) finds that Hispanics in Census SMSA groups with a higher percentage of Hispanics are more likely to be self-employed. Le (2000) finds positive effects of enclaves on self-employment among immigrants in Australia. McManus (1989) finds that poor speakers have more jobs requiring communication skills and higher earnings the bigger the percent of co-ethnics in their county. Clark and Drinkwater (2002) find that individuals in the UK are most likely to be self-employed when they live in a region with the fewest coethnics, and that there is little evidence that ethnic minority self-employment is related to language-specific trading groups in enclaves.

Evans (1989) creates a language-based variable of group size using Australian data to test the hypothesis that immigrant enclaves form an isolated labor pool. Although her primary interest was cultural elements, she finds that immigrants belonging to an ethnic group with a large percentage of individuals

with no or poor English skills are more likely to be self-employed compared to groups with complete English proficiency. She also finds that immigrants in a large ethnic group are more likely to be self-employed than immigrants in a small ethnic group.

3.2.2 The Role of the Family and Self-Employment

Few researchers have explicitly examined family models of self-employment decision-making. Baker and Benjamin (1997) present Canadian evidence that the labor supply decisions are jointly taken by immigrant husbands and wives, with wives subsidizing husbands' human capital accumulation. Blau et al (2003) do a similar analysis using U.S. Census data and do not find this result in the U.S..

However, there is substantial evidence that family plays a large role in the self-employment decision. Family members may provide technical assistance or access to credit, which have been shown to increase the possibility of self-employment (Dunn and Hotz-Eakin (2000), Blanchflower and Oswald (1997)). Other family members can provide a steady wage or other benefits, such as insurance, which mitigate the risk of self-employment. The role of a spouse in reducing risk is discussed in Borjas (1996). The role of spousal insurance is discussed in Lombard (2001) and Velamuri (2004).

In addition, the spouses and children of the self-employed are substantially more likely to be self-employed themselves. Families may have similar preferences for risk and independence, and workers who are already

self-employed can provide technical assistance and information to other family members. Blanchflower and Oswald (1997) show that fathers in more management-oriented jobs have children who are more likely to be self-employed, and Dunn and Hotz-Eakin (2000) show that children follow after their parents in profession.

Self-employed workers may also prefer to have other family members as employees. The business founder has more information about the skills and effort of family members than about outsiders. Since other family members have a direct stake in the success of the business, they are less likely to shirk. Thus, hiring family members may impose fewer search and monitoring costs than hiring outsiders. Additionally, people may prefer to work around people like themselves. Finally, a family business may be able to absorb the work of family members who want to work a small number of hours or are not employable on the market for the minimum wage. Other household members, for their part, may be able to provide a flexible source of temporary additional labor at peak times.

The family is likely to be even more important for immigrants, who have less access to formal sources of credit and information and greater difficulties finding a job on the market. The family provides a nearby network of people who are better known and can provide assistance to each other. The family's economic role in providing insurance and credit is greater for many immigrants from countries with poorly developed markets. In addition, immigrant families observed in the U.S. are a selected sample of families that may be especially

tightly-knit and inclined to help family members.

Although there is no model of a family business in which self-employment allows family members to capitalize on differences in there talents or abilities, Bosman et al (2000) incorporate a similar concept in a paper examining the return to the beauty capital of Dutch firms. In addition to the positive effect of average worker beauty on firm productivity, they find that firms with a greater dispersion of worker beauty have higher productivity. The argument is that workers in such firms can specialize, and that specialization pays off.

3.2.3 English Skills of Immigrants

Most working immigrants in the U.S. speak English well or very well, as shown in Chart 3.3. A sizeable group speaks only English. English skills depend on age of entry, education, and years in the U.S.. Only 3% of college-educated immigrants speak no or poor English compared to 57% of immigrants with less than a high school education. Some 7% of all immigrants in the sample speak no English, compared to 19% of immigrants who entered the U.S. after the age of 45.

The distribution of English skills varies by region of origin. Mexico and Central America provide the highest number of immigrants with no or poor English. A large number of South Americans and East Asians also speak poor English. For Southeast Asia, Southwest Asia, the Middle East, and Africa, most people speak English very well or as a sole language. Central Americans and Southeast Asian households are most likely to have a mixed composition

of English skills in the household. Some 28% of Central American households and 20.4% of East Asian households have both at least one non-speaker or poor speaker and at least one very good speaker or monolingual speaker.

3.3 Model

In models of the self-employment of individuals, an individual will be self-employed if the utility gained from self-employment is greater than that of utility from wage employment, or $U(SE) > U(WAGE)$. The direction of this inequality depends on the relative return between market and self-employment to basic human capital characteristics such as education, experience, entrepreneurial talent, and language skills. Decisions about self-employment also depend on individual preferences and attitudes towards risk and independence and on factors that influence the feasibility of entering self-employment, such as the availability of credit or access to information. There may also be constraints to entering wage or self-employment, such as discrimination or lack of documentation.

For my model, I take two workers whose choice of self-employment or wage employment depends only on the relative wage. I assume wages in both types of work are equal to the marginal product of labor, and depend on the workers' human capital HK and their language skills. Adequate communication skills are important to realize the worker's full productive capacity. Thus, $wage = MPL = F(\theta, HK)$ where θ is an index between 0 and 1 representing the degree of communication. If $\theta = 1$, there is no communication problem

and the wage depends only on HK. However, if employers and the employee or employees and clients communicate imperfectly, the wage is some fraction of what it would be if everyone spoke a common language. In a simple formulation, we could imagine a job in which wage$= \theta * MPHK$.

The two workers speak a common language besides English and each has the same productivity in an environment where this language is spoken. However, Worker A does not speak English fluently. The wages in both wage employment and self-employment if both workers seek work independently are thus $wA = \theta w$ and $wB = w$.

If the two workers work together, they can tailor jobs to maximize total earnings. An example would be an arrangement where the worker who speaks English well works at the counter, and the worker who speaks English poorly works in the stock room. Worker A will accept any self-employment wage such that $w_{se}A > \theta w$, and Worker B will accept any self-employment wage such that $w_{SE}B > w$. If collaboration implies that both workers reach their full potential wage, the additional income from tailoring jobs is $(1 - \theta)w$. The workers can bargain over how to split this increase, but either worker who controlled total company income would be willing to give the other up to this amount over her market wage to induce her to join the business. Even if self-employment is less productive or more costly for one or both of the partners individually, it may be beneficial if they cooperate.

If neither speaks fluent English, the wage of Worker A is $\theta_A w$ and the wage of Worker B is $\theta_B w$, with $\theta_B > \theta_A$. If collaboration means that the

productivity of the worse speaker is increased to the productivity of the second, the total wage gain is $(\theta_B - \theta_A)w$. The maximum gain to collaboration occurs when the language abilities are as different as possible, or when $\theta_A = 0$ and $\theta_B = 1$.

The dynamic in a family is similar. Total family income is equal to $\Sigma\theta_i w$ if all workers work separately, and $n * max(\theta_i w)$ if they collaborate. This model does not require altruism in the household. It assumes the same returns to English skills in self- and wage-employment, but this assumption is not needed. It may be that there is a greater disadvantage to poor English skills in wage work, which supports the finding that poor and good speakers are more likely to be self-employed. What is important is that there is a positive return to English skills in both wage and self-employment, which is supported by the literature. Cooperation reduces the penalty to having poor English skills, so that individuals who may have chosen wage employment before now have an incentive to enter self-employment.

3.4 Methodology and Data

3.4.1 Model Specification

To test the effect of language skills on the likelihood an individual is self-employed, I use a probit specification as follows:

$$Pr(SE) = \Phi(X'\beta + Z'\gamma + C'\delta + \epsilon)$$

Where Φ is the cumulative normal distribution function, X is a vector of personal characteristics, Z is a vector of household variables, and C is a vector of community characteristics.

In addition to the usual labor supply variables , the vector X contains indicator variables for own English level. The vector of household variables contains variables specifying the number of workers who speak English at each level (No English, Poor English, Good English, and Only English). Since the number of workers in the household is also controlled for, the number of very good speakers is omitted. Household variables also include the average level of education, years in the U.S., and age among workers in the household. Finally, a measure of the range of English skills among foreign-language speakers in the household is included. This variable is defined as ,

$$Range = max(ENG|notOnlyEnglish) - min(ENG|notOnlyEnglish)$$

where ENG is a discrete measure of individual English skills valued from 1-5 for the categories listed above. *Range* is a discrete variable with values between 0-3. Only English speakers are not included in the calculation since they are less able to translate. However, alternate specifications which included only English speakers in the calculation of *Range* produced similar results. For households with only "only English" speakers, the value of *Range* is set at 0.

subsectionData The data are the 1980, 1990, and 2000 Integrated Public Use Microsamples (IPUMS) of the U.S. Census. The Census provides information on place of birth and citizenship status, allowing me to identify immigrants. Since 1980, the Census has asked respondents to rate their own language abilities according to five categories: does not speak English, speaks English but not well, speaks English well, speaks English very well, and speaks only English. I use these to construct indicator variables for individual and household language skills.

I extract foreign-born persons between the ages of 25 and 60 who entered the U.S. after the age of 15 and who are currently working. The age restrictions are to avoid confusing decisions about self-employment and decisions about education and retirement. Unpaid work for a family member or relative is categorized as self-employment . I exclude immigrants from Puerto Rico or U.S. protectorates and U.S. citizens born abroad. Finally, since my analysis relies on the English skills of others working in the family, I exclude households with only one earner from the data set. This removes 27% of the otherwise eligible immigrant households. Alternate regressions on all households produced similar results.

All of the household language variables and household characteristics are based on the language skills of other members of the family who are currently employed. This might create some selection problem, since language skills also influence who is in the labor force and who is employed. However, alternate regressions using variables based on all family members 16-60

and all household members 12 and older produce similar results, although the magnitude of coefficients is weaker.

3.5 Descriptive Statistics

Table 3.2 reports the summary statistics for the entire sample. The sample contains observations on 651,215 male and female immigrants from 423,138 households with two or more earners. A substantial percent of immigrants speak English poorly. A full 32% of the immigrants were born in Mexico/Central America. The percent of the sample self-employed is 12%.

Table 3.3 presents statistics on the distribution of the range of English skills in the household. Most immigrant households have no variation in English skills - 60% have only members with the same English skills or combinations of one level of English and monolingual English. A little more than 25% have a one-step difference in English skills, i.e. a good speaker and a very good speaker. Some 12% have a two-step difference. Finally, only 3.1% have a three-step level of difference. The range in English skills varies by household size and own English skills. Two-earner households have an average range of only .35 steps, while households with four or more earners have an average difference of 1.2 steps. Some 78% of very good speakers live in households where other workers speak English very well or as an only language, and only 1.8% have a nonspeaker in the household who is working. In contrast, 19.7% of nonspeakers are in households where another worker speaks English very well.

Separate means by region are not reported. However, given that they have the most dispersion of language skills overall and the largest family sizes, it is not surprising that immigrants from Mexico and Central America have the highest dispersion of language skills, followed by South Americans. The average for Mexicans and Central Americans for *Range* is .95, compared with an overall average of .59 in all households. Immigrants from the main Commonwealth counties (the United Kingdom, Canada, Australia, and New Zealand) have almost no variation in worker English skills.

3.5.1 Individual English Skills and Self-Employment

The Census results show a concave relationship between English skills and self-employment in the entire sample. However, the association between mean English skills and self-employment rates varies by gender and region and has changed over time. Table 3.4 shows the means of self-employment aggregated, for all years, and by gender for immigrant workers aged 25-60. Good speakers have the highest self-employment rate overall, followed closely by very good speakers. Not controlling for any other factors, non-English speakers in the sample are about 58% as likely to be self-employed as those who have good English: 6.2% of working immigrant nonspeakers in the target group are self-employed, compared to 12.9% of good speakers and 12.4% of very good speakers.

The association between language skills and self-employment has changed over time in ways that are different for men and women. In the 1980 Cen-

sus, non-English-speaking men in the target group had a self-employment rate of only 3.3%, while 15.5% of very good speakers were self-employed. The self-employment rates for women were lower than those of men in almost every category, with nonspeakers having a self-employment rate of only 2.8%. Over time, the self-employment rates of men have fallen for good speakers and risen slightly for poor and non-speakers. For women, on the other hand, self-employment has gone up in all categories, but especially for non- and poor speakers. While the self-employment rates of women who speak English well or better remains below that of men in similar categories, at the two lower English levels women's self-employment is higher. While women's self-employment in the general population has also gone up, the increase has mostly been for more educated women (Devine, (1994)).

Of course, English skills are correlated with a wide range of other characteristics that influence self-employment. In addition to the effect of language skills, these means capture the influence of education, own ability, experience in the U.S., commitment to the U.S. labor market, and degree of assimilation, among other things. Table 3.5 reports regressions of self-employment on individual characteristics for working immigrants 25-60 overall controlling for some of these factors. The first three columns report only the variables specified, while the fourth column represents a full specification which controls for all relevant personal characteristics, region of birth, and state of residence, but not household English skills. The omitted language category is "Speaks English Very Well". Overall, over 75% of the lower self-employment of poor

speakers is explained by lower education and fewer years in the U.S.. Among workers of a given educational level, those who speak English poorly or well are more likely to be self-employed. Self-employment rates also vary substantially by region of birth.

When the full range of characteristics is controlled for, including region of birth and state of residence, non-English speakers are about as likely as very good speakers to be self-employed, and good and poor speakers are more likely to be self-employed by about the same margin. Western Europe and Southeast Asia are the only regional divisions whose emigrants who are good speakers do not have significantly higher self-employment once other factors are controlled for than very good speakers. Own English skills are jointly significant, however, for all regions except the UK, Canada, and Australia and Africa - areas where the overwhelming majority of immigrants speak English very well or as a sole reported language.

3.6 Results

3.6.1 Effect of Range of Household English Skills on Individual Self-Employment

Much evidence points to separate determinants of self-employment for women. Therefore, I run regressions on men and women separately. Results are reported in Table 3.7.

Once the characteristics of other household members are taken into account, poor English skills are slightly less of a deterrent to self-employment.

While non-English speakers are less likely to be self-employed than very good speakers (the omitted category), both poor and good speakers are more likely to be self-employed. Those who speak only English are slightly less likely to be self-employed. For women in particular, poorer English skills are associated with higher self-employment, once education and experience are controlled for. As expected, having additional nonspeakers and "Only English" speakers in the household reduces the individual's likelihood of being in self-employment, since these are the groups less likely to be individually self-employed.

Household range of English skills has a significant positive effect on individuals' self-employment. There is a .3 percentage point increase in the probability of self-employment for each increase in the *Range* variable over the entire sample. This is only slightly less than the effect of an additional year of education or experience in the U.S.. This implies that, controlling for the number of workers in each of the language categories and their average education, age, and experience in the U.S., someone with good English skills who had either a poor or very good speaker would be 3.2% percent more likely to be self-employed than someone with another speaker who had the same language skills, taking the predicted self-employment rate at mean values of 10.36%.

The measurement for *Range* was significant for men in all specifications, while for women it was significant only for three-earner households when separate regressions were run by number of workers in the household (not reported). For men, the coefficient on Range is .003 overall, representing

an increase of 3.1% increase over predicted mean self-employment for each increase in *Range*. For men in three-earner families, the coefficient of .005 implies a percent increase of 4.63% over predicted self-employment at the sample means and 3.83% over the actual average mean.

The signs of the other coefficients are mostly as expected, although the effects of many key variables vary by gender. Women are less likely to be self-employed, and this difference is more pronounced for those with higher English levels. Age, education, and years in the U.S. are associated with an almost linear increase in self-employment. Children under 5 significantly increase the probability of women's self-employment, in line with previous research that self-employment reflects a demand for greater flexibility for women. Average education, age, and experience in the U.S. of other workers in the household has very little association with higher self-employment once other factors are controlled for, although the effect of household education is more important for women.

3.6.2 The Effect of Household Language Skills by Own English Skills

Since my hypothesis is that having others with different language skills affects self-employment, the variables that are of interest to the model are the effects of other speakers on individuals with different language skills. If the model is correct, then the effect of the English skills of others in the household will vary by own English skills. Individuals with poor English skills

will have a higher probability of entering self-employment if there is someone in the household who speaks English well. Those with good skills will have a higher probability of entering self-employment if there is another household member with poor English skills. Both poor and good speakers will have increased probabilities of self-employment in the context of a family with a mix of English skills.

Having others in the family with different skills does result in a higher self-employment probability, as seen in Tables 3.8 and 3.9. Having an additional non-English-speaking worker in the family, instead of a very good speaker, significantly reduces self-employment for non-English-speakers and poor speakers (taken together) in every specification. They have a negative effect in most specifications on the self-employment probabilities of good speakers, but the effect is not significant most of the time. On the other hand, having an additional non-English-speaker instead of a very good speaker increases the self-employment probability of very good speakers. A man who speaks English very well is 1.5 percentage points more likely to be self-employed if an additional non-English-speaker is added to the household, while a woman is 1.1 percentage points more likely to be self-employed. The same pattern holds for poor speakers. Having an additional good speaker has a slight negative effect for non/poor speakers and a positive effect for very good speakers. Additional English-only speakers have a negative effect on all groups. The results support the model, and are stronger for men.

English-only speakers are the only group for whom, in separate regres-

sions, the null hypothesis that the language skills of others in the household have no effect on the probability of self-employment cannot be rejected. It would be tempting to say that this is because household language skills do not play any role for monolingual English speakers: since they cannot speak the other language, they might make poor translators. However, these are all immigrants with only English skills, not native-born Americans who live with immigrants. Immigrants who speak only English are much more likely to be married to a nonimmigrant. They have almost no little variation in household English skills. Some 87.8% live in households where no one speaks a language other than English. Another 8.9% have a very good or good speaker in the house, and only 2.6% a poor or nonspeaker. In addition, the sample size of this group is smaller than for the other groups. The coefficients on the number of other non- and poor speakers are positive and almost significant for non-speakers, so it seems likely that a larger sample size might produce stronger results.

Although not reported, the effects are largest for men in three-earner households. Here, having a nonspeaker rather than another very good speaker increases the self-employment likelihood by 3.6 percentage points on average for very good speakers, while having another poor speaker increases the self-employment probability by 2.1 percentage points. This represents a 30.5% and 17.8% increase over the predicted self-employment (11.82%) for this group. However, this group is small.

3.6.3 Household Language and Language Prevalence

Sociologists have long hypothesized that enclaves increase immigrant self-employment through social networks which provide informal finance and information. (Light (2000), Aldrich and Waldinger (1990)). Enclaves also may provide a niche market that co-ethnics have an advantage in serving (Light 2000), and provide a source of cheap immigrant labor.

While the mechanism is not clear, there is some empirical evidence that enclaves do increase immigrant self-employment. Most notably, Borjas (1986) finds that Hispanic men who live in metropolitan areas with more Hispanics have higher self-employment rates. The effect is stronger for immigrants, but also significant and positive for native-born Mexican-Americans. He finds no similar result for non-Hispanics, either immigrant or not. Without offering an explanation for how this mechanism works, he suggests it may involve a cultural or linguistic advantage of Hispanics in providing services to a Hispanic population.

Could the results be reflecting the effect of immigrant enclaves, instead of the family? Immigrants with poor English skills are more likely to live in an enclave. It could be that families with a mix of English skills also tend to be located in enclave areas. If immigrant self-employment is more common in enclaves, as many studies have concluded, then the positive coefficients on *Range* could be picking up the effect of living in an enclave rather than of household language skills.

I calculate a variable to capture the effect of immigrant enclaves by measuring the percent of others in the metropolitan area who speak the same language . This is a rough substitute for a true enclave, which would be much smaller. Unfortunately, the IPUMS does not provide small Census units for analysis - the smallest possible geographic unit available for analysis is the PUMS and SUPERPUMS, which contain a minimum of 100,000 and 400,000 persons respectively, and these are not comparable across Census years.

Individuals who speak a foreign language from families with a greater range of language skills do tend to live in metropolitan areas with a greater prevalence of their native language. Workers in households with the maximum value of the *Range* (i.e., those that have both a non-English-speaker and a very good or Only English speaker or a poor speaker and an Only English speaker) live in metropolitan areas where 18% of the population speaks the same language. However, among individuals with no variation in their household English skills, only 8% of others in their metropolitan region speak the same language. (English only speakers are excluded from these means). Non-speakers are the only group that is more likely to live in an area with lower prevalence of their language if there is a higher range of English skills in their own household. (Table not included).

The effect of language prevalence in this sample depends on the specification used. When percent language prevalence is enter in a regression with the full specification used earlier, there is a small positive effect on self-employment for men and small negative effect for women. However, if a log specification is

used, there is small negative effect. The distribution of language prevalence is very skewed, with many observations tending towards zero.

Regressions including prevalence and log prevalence and the interaction of these variable with *Range* do explain some of the effect of the range household English skills, as reported in Table 3.10. In the non log specification, the coefficient of *Range* drops from .007 in the group of all men speaking foreign languages and .005 in the group of all women speaking English to .002 and .001 in the regression with women (here, prevalence is added as a percent, so the effect of a one-percent increase in language prevalence is 1/100 of the coefficient). However, there is still a positive coefficient on *Range*. These regressions are only on persons who report a native language other than English. There is a significant interaction term for the sample of all speakers for both men and women in the log specification, indicating that a spread of English is more important in areas with higher language prevalence. This is opposite to what might be expected from the model, which would suggest that household English skills would matter more in areas where there was a greater return to English skills. However, the interaction term is not significant in other specifications.

For men who speak no or poor English, there is no significant effect of *Range* after controlling for log language prevalence. For men who speak good or very good English, the effects of English Range are significant and positive. Once language prevalence is controlled for, women who speak English very well also have a significant positive effect of Range.

The estimated effects of language prevalence on self-employment probability are not robust to changing specifications. There are many extreme values of prevalence, with one group — Spanish speakers — having a much higher average than every other language group. There are also quite a few observations where language prevalence is close to zero. In the log specification, log language prevalence has a negative effect on self-employment. When entered as a level, language prevalence has a positive effect. Overall, accounting for language prevalence reduces the coefficient on *Range* slightly for the pooled group.

3.6.4 Regional Differences

As Fairlie and Meyer (1994) emphasize, self-employment rates vary among groups with different national origins. Immigrants from different areas also have different linguistic and cultural resources available in the U.S.. It seems plausible that the effect of language and household language skills also varies by region.

Omitting the Commonwealth countries and Africa, which have high rates of English-only speakers and small sample sizes, I use the specification with log language prevalence from above on each region separately (Table 3.11). *Range* has a positive effect in all regions except the Middle East, where it is insignificant. The effect is primarily for very good and good speakers. Mexico is the only country which has a significant positive effect for non/poor speakers. The effect is particularly strong for East Asia and Southeast Asia.

For Mexico, at the mean levels of self-employment, an additional increment of *Range* would lead to a 3.3% increase in self-employment for non/poor speakers and a 7.9% increase for very good speakers; for East Asia, there is a negative 6.4% effect on non/poor speakers and a 14.7% increase for very good speakers, and for East Asia there is a 4.6% increase for good speakers and 9.5% for very good speakers.

3.7 Discussion

3.7.1 Alternate Explanations

The results broadly support the hypothesis that trade in English skills within families encourages self-employment. However, there are a number of alternative theories which would also explain my findings.

The positive effect of having a very good speaker on the self-employment of poor speakers is not in itself surprising. Having a better speaker may indicate that the family has more resources, which would encourage self-employment on its own. If poor speakers have tighter credit constraints than good speakers, this could explain the difference of the effect of poor speakers compared to very good speakers. Information on savings is not available in the Census. The inclusion of own English and average household education in the regression should control for this effect. The fact the very good speakers on their own are less likely in most cases to be self-employed also argues against this effect.

Families with mixed English skills could also be families with a greater

commitment to the U.S. labor market, shown by the immigration of more of the family. Alternatively, these families could be exceptionally tight-knit, which could affect their likelihood of having a family business. In this case, the estimates would be biased up. Although there is no information on intentions about staying in the U.S., controls for time already spent in the U.S. should account for much of this effect.

Mixed English skills might indicate a less assimilated family. If self-employment is a response to discrimination or there is some unexplained factor about being more "foreign" that leads to self-employment, less assimilated households might have more self-employment. If assimilation and *Range* are correlated as well, this could introduce a spurious effect of *Range* on self-employment. It is unclear what that relationship might be, and why, if it existed, households with all poor speakers would not be more likely to be self-employed. Moreover, language-prevalence should proxy for many of the effects of non-assimilation.

Rather than tailoring jobs to suit the family, immigrants could actually be tailoring the family to suit the job. This could be accomplished in the household through marriage and fertility decisions and decisions about how much language to invest in. Decisions are also made about who lives in the household (instead of in their own home), which relatives to immigrate with, and which order the family should come over in (all at once or over time). Although this would be the inverse of the process in my model, it would support the fundamental premise: families would be using self-employment as

a collaboration which enabled them to maximize earnings in a more efficient manner than if they had to seek employment separately.

Language skills themselves are not exogenously determined. Immigrants make decisions about whether to immigrate, where to immigrate to, and who to immigrate with based in part on their human capital characteristics, including English skills. Immigrants with different levels of English skills before immigration likely have very different expectations of the type of jobs they will look for when they reach the U.S.. Mexican immigrants who speak English more poorly are more likely to live in areas with large numbers of other Mexican immigrants, but it is not clear if this is because immigrants with poor skills choose these areas or if immigrants who live around colinguals have less incentive to learn English. Once in the U.S., decisions about how much to invest in English depend on linguistic ability, work skills, and occupational choices. It could be that families with a business have an incentive to invest in language training only for some of their members, whereas members of families where all family members are wage-employment have equal incentives to invest in English (or not). While this would still show the active role of the family in influencing decisions, it would represent a different mechanism than the one presented in my model.

Finally, this work uses the household as the basis for analysis. The household is an imperfect substitute for economic unit of true interest, the family. The data set has no information on the influence of family members living outside of the household or outside of the country. Therefore, the esti-

mated effect will underestimate the true role of family.

A more difficult problem is that household composition may be endogenous, in that household composition depends on preferences for family size and housing arrangements. Extended families with more income may be able to afford separate households, making a large family appear as small households for wealthier families or families who value individual space more. If there is no systematic reason to believe different mechanisms are at work for households who choose different housing arrangements, then this simply introduces measurement error and will bias the coefficients toward zero, which would strengthen the estimated effects. However, it is not clear how preferences for household size are related to preferences for cooperation between household members or household language skills.

There is also temporal problem. Individuals may choose self-employment early in their careers, and then remain self-employed even though the household structure changes. The important variable may actually be family characteristics at the time initial work decisions are made, not at the time of the interview. If current household English is a poor proxy, it will bias the coefficients toward zero and the actual effect might be greater. Including years in the U.S. and own age partially control for this effect.

3.7.2 Selection Issues

There are several levels of selection in this specification of the model. Both a person's own English language skills and the language skills of the

household influence not only self-employment status, but also labor force participation and the probability of being employed. The present analysis selects only workers who are currently employed, ignoring the effect of *Range* on the probability of being in the labor force or employed. Second, the *Range* variable itself is defined over others in the household who are working, although who works in the household may itself be determined by the mix of English skills in the household. Finally, I select households with two or more earners.

In the first selection issue, self-employment is reliably observed only for those who are actually working. If labor force participation or employability are systematically correlated with unobserved factors determining self-employment or if employment and self-employment are jointly determined, then the estimates might be biased. If some identifying variable could be identified which affected the probability of working but not self-employment, a standard Heckman procedure could be used to produce consistent estimates. However, it is difficult to find such a variable. Factors such as the number of small children which are used by Mroz to identify labor force participation probabilities are correlated with self-employment, at least for women. Typically selection is seen to be an issue for women's labor supply. However, in this sample, a substantial percent of men report not being in the labor force — just under 15%. This percent is higher for those who do not speak English fluently. Unemployment rates for immigrants are also high for poorer English speakers.

In the second selection issue is the restriction of the sample to house-

holds with two or more earners. Because of the way *Range* is defined, there is no variability in *Range* in households with only one earner. This ignores the issue that household language skills may influence how many people in the household participate in the labor force and how many actually work.

An alternative definition of the range of household English skills can be used to examine how they effect labor force participation and employment. Let *Range2* be the range of English skills of all persons in the family between the ages of 16 and 60, regardless of whether they work or not. The language variables for others in the household are similarly redefined to include the skills of all family members between the ages of 16 and 60.

Results are reported in Tables 3.12 and 3.13. *Range2* has a negative effect on men's labor force participation and on the employment rate of men who are in the labor force. It has a small positive effect on women's participation and employment. For both men and women, having additional family members who speak good, poor, or no English instead of very good English is associated with higher participation rates and higher employment among those on the labor market. For men who speak very good English, the range of English skills has no effect on labor force participation or employment. All women, however, are more likely to be in the labor force if others in their household speak good, poor, or no English rather than very good English.

Household English has less of an effect on the probability of being employed given that one is in the labor force, but good, poor, and non-English speakers are more likely to be employed if others in the household are also less

than very-good English speakers.

Finally, controlling for the number of persons 16–60 in the household, households with a greater range of English skills have fewer earners on average. Controlling for the number of persons in the family 16 and up, each additional increment of *Range2* is associated with decrease of .08 in the number of persons in the household who are currently working.

3.8 Conclusion

This chapter has examined one way in which household human capital might affect self-employment. It presents a model in which immigrants with different language skills can cooperate to earn more together than they would be able to earn individually. Although it fits in naturally with families that maximize family utility or are altruistic, it does not require these assumptions.

Immigrants with poorer language skills are less likely to be self-employed. However, this is mostly because these immigrants are on average younger and have less education and less experience in the U.S.. At a given educational level, immigrants who speak English poorly or well are more likely to be self-employed than those who speak English very well.

Household English skills also matter for individual self-employment. In the sample of all working immigrants in the target range, adding one level to the range of English skills to the household increases self-employment by about 3% (.3 percentage points) overall and for men, with a larger effect on

families with more earners.

In addition, there is a positive effect on self-employment of having others in the family who speak a different level of English. Very good speakers are more likely to be self-employed if there is an additional poor or non-speaker of English in the family, and vice-versa. This pattern is stronger for men than for women. For men who speak English very well, having an additional non-English-speaker or poor speaker rather than a very good English speaker increases the self-employment probability by 1.5 and 1.4 percentage points respectively, while it reduces self-employment for non-/poor English speakers by .8 percentage points. Having an additional non-English speaker increases the probability of self-employment of a women who speak English very well by 1.1 percentage points, but decreases the probability of a non-/poor- English-speaking women by 1.9 percentage points.

This basic pattern holds for all most regions. It is particularly strong for East Asia. When the percentage point coefficients are converted into percent change over mean self-employment, the effects of an additional increase in household English skills increases the probability of self-employment for very good speakers from 8% in Mexico to 14% in East Asia. The effect for non- or poor speakers is significant only for Mexico, where poor speakers are 3.3% more likely to be self-employed for each increase in the Range variable.

These results provide important information about immigrant self-employment. First, better English skills do not increase self-employment on their own, although other studies have shown they are associated with increased wages and

better jobs. However, for households with poor speakers, having an additional very good speaker does increase self-employment.

An expansion of this chapter might investigate the interaction between household language skills and linguistic enclaves more extensively. Linguistic enclaves seem to be associated with more self-employment for immigrants from Mexico and Central America and less self-employment for immigrants from other regions. The answer may depend on the ethnicity of customers and potential employees. Larger enclaves, or more concentrated enclaves that are not observable in the IPUMS data, may create different self-employment opportunities or change the role of language. Preliminary research indicates that the interaction between individual and household language skills varies by region.

Another area that is interesting is the role of isolation in self-employment. Communities which seek to maintain their cultural heritage or religious homogeneity — i.e., ones that seek to avoid assimilation - might have a strong preference for working with members of their own group — people who speak the same language, laugh at the same jokes, and share the same basic belief system. Researchers who have examined religion in economic terms show how strict religious demands can act as sorting mechanisms to ensure a dedicated membership, and how barriers to interaction with outsiders form an important part of these mechanisms. Do groups which seek to maintain communities with values outside the mainstream have higher rates of self-employment? If this was true, we might see higher self-employment rates among such groups.

Not speaking English can be both a consequence of this isolation, but also a way of keeping outsiders out of the group.

Finally, a complementary model of self-employment for immigrants would examine self-employment as a way to overcome problems in signaling qualifications to U.S. employers. Immigrant men who have college-level education overseas are more likely to be self-employed, and that these coefficients are larger for non-English speakers and poor-English speakers than for good or very good English speakers.

The family may also help employ family members who cannot recognize their full potential in the labor market in other ways other than language. Self-employment may offer individuals who are underage or older than usual, want flexible work hours, or are unable to find work at the minimum wage a better work package than they could find in wage employment. Self-employment might provide an opportunity for families to help these workers.

Table 3.1: Countries by Self-Employment Rate

1	Korea	25.05%	22	Peru	10.93%
2	Greece	25.00%	23	Portugal	10.84%
3	Israel	24.80%	24	India	10.82%
4	Iran	21.92%	25	Nigeria	10.34%
5	Italy	18.10%	26	Thailand	10.33%
6	Brazil	17.94%	27	Africa NS	10.00%
7	Argentina	16.73%	28	Guatemala	9.78%
8	Ireland	15.47%	29	Ecuador	9.56%
9	Pakistan	14.99%	30	Yugoslavia	9.12%
10	Poland	14.66%	31	El Salvador	9.00%
11	Cuba	13.17%	32	Dominican Rep.	8.90%
12	Canada	13.12%	33	Nicaragua	8.73%
13	France	12.97%	34	Honduras	7.81%
14	England	12.52%	35	Mexico	7.79%
15	Germany	12.46%	36	Trinidad	7.31%
16	USSR (Non-Balt)	12.32%	37	Jamaica	6.87%
17	Japan	12.21%	38	Br. West Indies	6.25%
18	Colombia	12.08%	39	Guyana	6.14%
19	China	11.16%	40	Laos	5.46%
20	Vietnam	11.12%	41	Philipines	5.26%
21	Cambodia	11.00%	42	Haiti	5.01%

Includes all workers 25-60. Countries with 2,500 or more persons in sample

Table 3.2: Summary Statistics HH with 2 or More Earners

	Mean	Std. Dev.
	Own English	
None	0.082	0.275
Poor	0.202	0.401
Good	0.258	0.437
V. Good	0.316	0.465
Only	0.142	0.349
English 1-5	4.27	1.37
	Personal Characteristics	
Age	40.73	9.61
Education	11.44	4.51
Yrs in US	13.69	9.16
Self-Employed	0.12	0.32
Overseas College	0.318	0.466
Female	0.456	0.498
Married	0.787	0.410
Divorced	0.081	0.273
Single	0.132	0.339
U.S. Citizen	0.404	0.491
	Household	
Range of HH English	0.590	0.817
Eng Ave	3.464	1.065
Ave. Edu	11.92	3.81
Ave. Yrs in US	18.02	13.48
Ave. Age	36.26	10.29
Children ¡5	0.215	0.512
Own Children	1.36	1.40
	Regional Distribution	
Commonwealth	0.074	0.261
Mexico/CA	0.323	0.468
South America	0.073	0.261
Western Europe	0.068	0.252
Eastern Europe	0.093	0.290
East Asia	0.112	0.315
Southeast Asia	0.142	0.349
Southwest Asia	0.056	0.230
Middle East	0.030	0.170
Africa	0.029	0.167

Table 3.3: Distribution of Range of Household English Skills by Own English Skills

Range of English	Own English			
	None	Poor	Good	Very Good
0	29.40%	33.36%	43.62%	78.55%
1	30.99%	33.99%	46.19%	13.51%
2	19.87%	29.86%	8.98%	6.19%
3	19.73%	2.79%	1.21%	1.75%

Table 3.4: Self-Employment by Year and Gender, Weighted Means

Year	English Level	All	Men	Women
1980	No English	0.033	0.037	0.028
	Poor English	0.072	0.079	0.064
	Good English	0.110	0.133	0.082
	Very Good English	0.121	0.155	0.087
	Only English	0.123	0.164	0.087
1990	No English	0.065	0.060	0.071
	Poor English	0.110	0.106	0.116
	Good English	0.135	0.147	0.120
	Very Good English	0.132	0.155	0.106
	Only English	0.138	0.158	0.118
2000	No English	0.069	0.055	0.091
	Poor English	0.111	0.099	0.128
	Good English	0.130	0.136	0.122
	Very Good English	0.116	0.135	0.095
	Only English	0.125	0.142	0.106

Table 3.5: Probit Regressions: Own English Skills and Self-Employment

	Spec. 1	Spec. 2	Spec. 3	Spec. 4
No English	-0.061	-0.047	-0.015	-0.008
	(0.001)***	(0.002)***	(0.002)***	(0.002)***
Poor English	-0.019	-0.006	0.016	0.012
	(0.001)***	(0.001)***	(0.002)***	(0.001)***
Good English	0.004	0.010	0.018	0.013
	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Only English	0.007	0.009	0.004	-0.006
	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Yrs. Edu.		0.002	0.002	0.004
		(0.000)***	(0.000)***	(0.000)***
Edu. Sq.		0	0	0
		(0.000)**	(0.000)***	(0.000)***
Yrs. in U.S.			0.007	0.004
			(0.000)***	(0.000)***
Yrs. U.S. Sq.			0	0
			(0.000)***	(0.000)***
Obs.	651,215	651,215	651,215	651,215
Chi2 Own Eng.				287.82

Table 3.6: Probit Regression, Own English Skills on Self-Employment, By Region (Full Specification)

	All	Mexico/CA	South Am	W. Europe	E. Europe	East Asia	SE Asia	SW Asia	Mid East	Africa
No English	-0.008	-0.013	-0.008	-0.089	-0.036	-0.032	0.045	0.028	-0.102	-0.034
	(0.002)***	(0.002)***	(0.007)	(0.009)***	(0.012)***	(0.009)***	(0.011)***	(0.026)	(0.034)***	(0.041)
Poor English	0.012	-0.004	0.005	-0.047	-0.03	0.095	0.037	-0.01	-0.019	-0.013
	(0.001)***	(0.002)**	(0.005)	(0.006)***	(0.005)***	(0.006)***	(0.004)***	(0.008)	(0.015)	(0.017)
Good English	0.013	0.005	0.009	0	-0.006	0.058	0.018	-0.001	0.027	-0.001
	(0.001)***	(0.002)***	(0.004)**	(0.005)	(0.004)	(0.004)***	(0.002)***	(0.005)	(0.008)***	(0.008)
Only English	-0.006	-0.001	-0.039	-0.02	-0.007	0.005	0.016	-0.018	-0.013	0.003
	(0.001)***	(0.003)	(0.004)***	(0.005)***	(0.004)*	(0.008)	(0.005)***	(0.006)***	(0.010)	(0.006)
Obs.	651,215	210,661	47,775	44,376	60,420	72,990	92,401	36,579	19,496	14,123
Chi2 Eng.:	287.82	89.24	100.79	117.28	31.3	513.19	120.23	10.69	27.37	1.27

Regressions also include education, age, and years in U.S. and their quadratics, marital status, overseas college, gender and number of children variables, year of Census, and state of residence. Overall regression includes region of origin.

Table 3.7: Effect of Household English Skills on Self-Employment

	All	Men	Women
No English	-0.006	-0.021	0.005
	(0.002)***	(0.003)***	(0.003)
Poor English	0.010	-0.005	0.026
	(0.002)***	(0.002)**	(0.002)***
Good English	0.011	0.007	0.015
	(0.001)***	(0.002)***	(0.002)***
Only English	0.000	-0.005	0.002
	(0.002)	(0.002)**	(0.002)
Other Nonspeakers	-0.008	-0.002	-0.010
	(0.001)***	(0.002)	(0.002)***
Other Poor Speakers	-0.001	0.001	-0.001
	(0.001)	(0.001)	(0.001)
Other Good Speakers	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)
Other Only English	-0.006	-0.005	-0.007
	(0.001)***	(0.001)***	(0.001)***
Range of HH English	0.003	0.003	0.001
	(0.001)***	(0.001)***	(0.001)
Ave. Edu. Others	0.002	0.001	0.003
	(0.000)***	(0.000)***	(0.000)***
Ave. Age Others	0.001	0.000	0.001
	(0.000)***	0.000	(0.000)***
Ave. Yrs US Others	0.000	0.001	0.000
	(0.000)***	(0.000)***	(0.000)
Overseas College	0.009	0.016	0.001
	(0.001)***	(0.002)***	(0.002)
Observations	651,215	354,543	296,672
Wald Tests:			
Own Eng:	163.74	125.63	189
HH Eng:	94.13	18.29	57.57

Controls for marital status, number of children, age, education, and years in the US and their quadratics, number of earners in the household, state of residence, year and region of origin also included.

Table 3.8: Effect of Household English Skills on Self-Employment, Men

	No/Poor	Good	V. Good	Only
Other Nonspeakers	-0.008	-0.005	0.015	0.023
	(0.002)***	(0.004)	(0.005)***	(0.011)**
Other Poor Speakers	-0.006	0.001	0.014	0.010
	(0.002)***	(0.003)	(0.003)***	(0.011)
Other Good Speakers	-0.004	-0.002	0.006	-0.008
	(0.002)**	(0.002)	(0.002)**	(0.010)
Other Only English	-0.001	-0.014	-0.008	-0.001
	(0.003)	(0.003)***	(0.002)***	(0.005)
Ave. Edu. Others	0.001	0.001	0.000	0.006
	(0.000)***	(0.000)***	0.000	(0.001)***
Ave. Age Others	0.000	0.000	0.000	0.000
	(0.000)**	0.000	0.000	0.000
Ave. Yrs US Others	0.001	0.001	0.001	0.001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Overseas College	0.019	0.010	0.011	0.024
	(0.004)***	(0.004)**	(0.003)***	(0.005)***
US Citizen	0.007	-0.002	0.000	-0.016
	(0.002)***	(0.003)	(0.002)	(0.004)***
Children<5	-0.003	0.001	0.000	0.014
	(0.002)*	(0.002)	(0.002)	(0.004)***
Own Children	0.005	0.010	0.011	0.001
	(0.001)***	(0.001)***	(0.001)***	(0.002)
Other HH Workers	0.001	-0.003	-0.007	-0.007
	(0.002)***	(0.003)***	(0.003)	(0.005)**
Observations	107,074	94,628	107,355	45,486
Wald Test:				
HH Eng:	26.08	24.08	45.29	7.75

Marital status, state of residence and region of origin also in regression.

Table 3.9: Effect of Household English Skills on Self-Employment, Women

	No/Poor	Good	V. Good	Only
Other Nonspeakers	-0.019	-0.008	0.011	0.007
	(0.003)***	(0.006)	(0.007)*	(0.012)
Other Poor Speakers	-0.007	0.002	0.003	0.012
	(0.002)***	(0.003)	(0.004)	(0.009)
Other Good Speakers	-0.002	-0.001	-0.004	0.012
	(0.002)	(0.002)	(0.002)	(0.008)
Other Only English	-0.006	-0.010	-0.007	-0.002
	(0.004)	(0.003)***	(0.002)***	(0.005)
Ave. Edu. Others	0.002	0.002	0.003	0.005
	(0.000)***	(0.000)***	(0.000)***	(0.001)***
Ave. Age Others	0.001	0.001	0.001	0.002
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Ave. Yrs US Others	0.000	-0.001	0.000	0.000
	0.000	(0.000)***	(0.000)*	0.000
Overseas College	-0.013	0.001	0.006	0.001
	(0.004)***	(0.004)	(0.003)**	(0.004)
US Citizen	0.001	-0.007	0.000	-0.006
	(0.003)	(0.003)***	(0.002)	(0.003)*
Childen<5	0.000	0.004	0.005	0.025
	(0.002)	(0.003)	(0.002)**	(0.004)***
Own Children	0.001	0.007	0.006	0.002
	(0.001)	(0.001)***	(0.001)***	(0.001)
Other HH Workers	0.006	0.003	0.007	0.002
	(0.002)***	(0.003)***	(0.003)***	(0.004)***
Observations	77,921	73,341	98,552	46,858
Wald Test				
HH Eng:	62.41	15.15	18.21	8.39

Marital status, state of residence and region of origin also in regression.

Table 3.10: Effect of Range of Language Skills and Language Prevalence

Specification 1: With Log Language Prevalence

	Men				Women			
	All	No/Poor	Good	VGood	All	No/Poor	Good	V. Good
Range	0.0040	0.0007	0.0041	0.0102	0.0026	0.0006	0.0006	0.0028
	(0.0008)	(0.0009)	(0.0018)	(0.0016)	(0.0008)	(0.0012)	(0.0020)	(0.0017)
Log Lan. Prev.	-0.0020	-0.0008	-0.0019	-0.0032	-0.0030	-0.0027	-0.0034	-0.0031
	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0002)	(0.0004)	(0.0004)	(0.0003)
Obs.	292,011	100,976	89,925	101,110	235,878	73,779	69,455	92,644

Specification 2: with Nonlog Language Prevalence

	Men				Women			
	All	No/Poor	Good	V. Good	All	No/Poor	Good	V. Good
Range 1-4	0.0022	0.0000	0.0035	0.0089	0.0011	0.0003	0.0019	0.0010
	(0.0007)	(0.0008)	(0.0015)	(0.0015)	(0.0008)	(0.0011)	(0.0019)	(0.0017)
Lan. Prev.	0.0498	0.0534	0.0320	0.0249	-0.0126	-0.0048	-0.0293	-0.0227
	(0.0054)	(0.0064)	(0.0101)	(0.0111)	(0.0056)	(0.0081)	(0.0123)	(0.0114)
Obs.	292,011	100,976	89,925	101,110	235,878	73,779	69,455	92,644

Baseline Without Language Prevalence

	Men				Women			
	All	No/Poor	Good	V. Good	All	No/Poor	Good	V. Good
Range	0.007	0.001	0.024	0.055	0.005	0.003	0.011	0.013
	(0.001)***	-(0.0010)	(0.010)**	(0.009)***	(0.001)***	-(0.0080)	-(0.0120)	-(0.0110)
Obs.	292,011	100,976	89,925	101,110	235,878	73,779	69,455	92,644

All *specification excludes only English speakers. Household Ave. Eng. controlled for in* All *specification.*

Table 3.11: Effect of Household English Range by Region,Men

	Mexico			
	All	No/Poor	Good	V. Good
dy/dx Range:	0.0023	0.0025	-0.0022	0.0069
	(0.0009)	(0.0013)	(0.0022)	(0.0021)
Mean Range	0.9769	1.0715	0.9828	0.6567
Obs.	120,875	68,055	32,110	20,701
	East Asia			
	All	No/Poor	Good	V. Good
dy/dx Range:	0.0085	-0.0161	0.0161	0.0279
	(0.0034)	(0.0045)	(0.0076)	(0.0075)
Mean Range	0.6468	0.9099	0.5695	0.4547
Obs.	30,770	10,069	11,560	9,141
	Southeast Asia			
	All	No/Poor	Good	V. Good
dy/dx Range:	0.0101	-0.0065	0.0089	0.0204
	(0.0029)	(0.0069)	(0.0043)	(0.0042)
Mean Range	0.5008	0.9441	0.5708	0.2953
Obs.	38,805	6,118	14,389	18,203
	Southwest Asia			
	All	No/Poor	Good	V. Good
dy/dx Range:	0.0114	0.0040	0.0150	0.0092
	(0.0075)	(0.0213)	(0.0135)	(0.0080)
Mean Range	0.3841	1.2083	0.5652	0.2562
Obs.	18,583	1,061	4,326	13,134
	Middle East			
	All	No/Poor	Good	V. Good
dy/dx Range:	0.0098	0.0118	0.0114	0.0145
	(0.0106)	(0.0299)	(0.0207)	(0.0136)
Mean Range	0.3874	1.1852	0.5628	0.2261
Obs.	10,225	648	2,896	6,600

Table 3.12: Effects of Language on Labor Force Participation

	Men	Women
No English	-0.05	-0.161
	(0.003)***	(0.004)***
Poor English	-0.046	-0.089
	(0.002)***	(0.003)***
Good English	-0.032	-0.04
	(0.002)***	(0.002)***
Only English	-0.031	-0.064
	(0.003)***	(0.003)***
Other Nonspeakers	0.017	0.045
	(0.001)***	(0.002)***
Other Poor Speakers	0.013	0.028
	(0.001)***	(0.001)***
Other Good Speakers	0.003	0.011
	(0.001)***	(0.001)***
Other Only English	-0.01	-0.009
	(0.001)***	(0.001)***
Range	-0.006	0.002
	(0.001)***	(0.001)**
Obs.	440,904	442,797

Table 3.13: Effects of Language on Labor Force Participation by Own English Skills

	Men				Women			
	No or Poor	Good	V. Good	Only	No or Poor	Good	V. Good	Only
Nonspeakers	0.019	0.022	-0.006	0.007	0.035	0.043	0.019	0.017
	(0.002)***	(0.003)***	(0.003)**	(0.004)**	(0.002)***	(0.005)***	(0.005)***	(0.008)**
Poor Speakers	0.022	0.014	-0.007	0.002	0.032	0.042	0.007	0.006
	(0.002)***	(0.002)***	(0.002)***	(0.004)	(0.002)***	(0.003)***	(0.003)**	(0.007)
Good Speakers	0.007	0.013	-0.009	0	0.004	0.032	0.006	0.001
	(0.002)***	(0.002)***	(0.002)***	(0.004)	(0.002)**	(0.002)***	(0.002)**	(0.007)
Only English	-0.021	-0.016	-0.022	0.006	0.006	-0.022	-0.029	0.009
	(0.003)***	(0.002)***	(0.002)***	(0.002)***	(0.004)	(0.003)***	(0.002)***	(0.004)**
Obs.	144,037	117,730	125,273	53,864	148,375	103,169	125,668	65,585

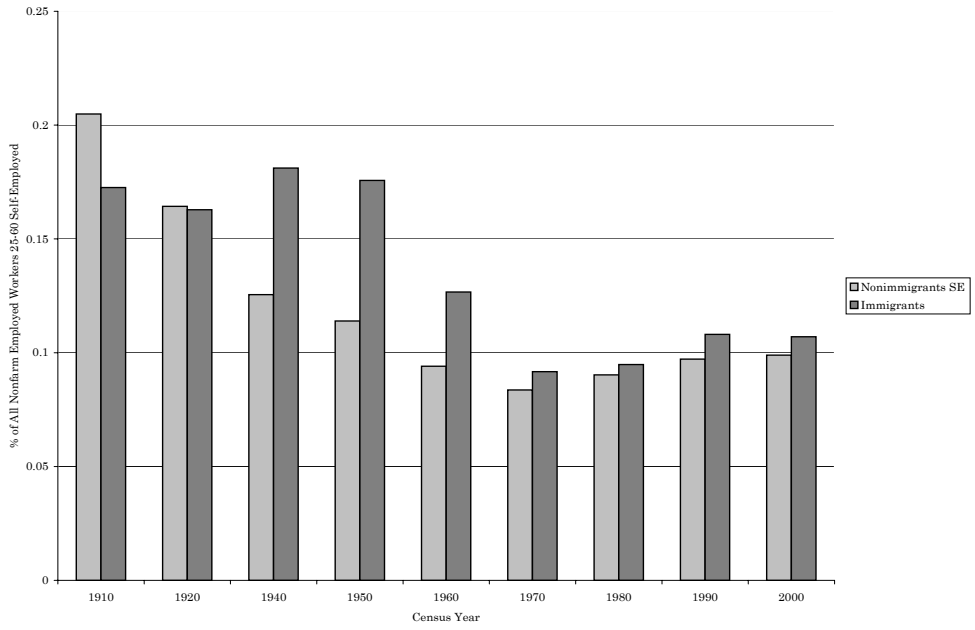

Figure 3.1: Immigrant and Nonimmigrant Self-Employment

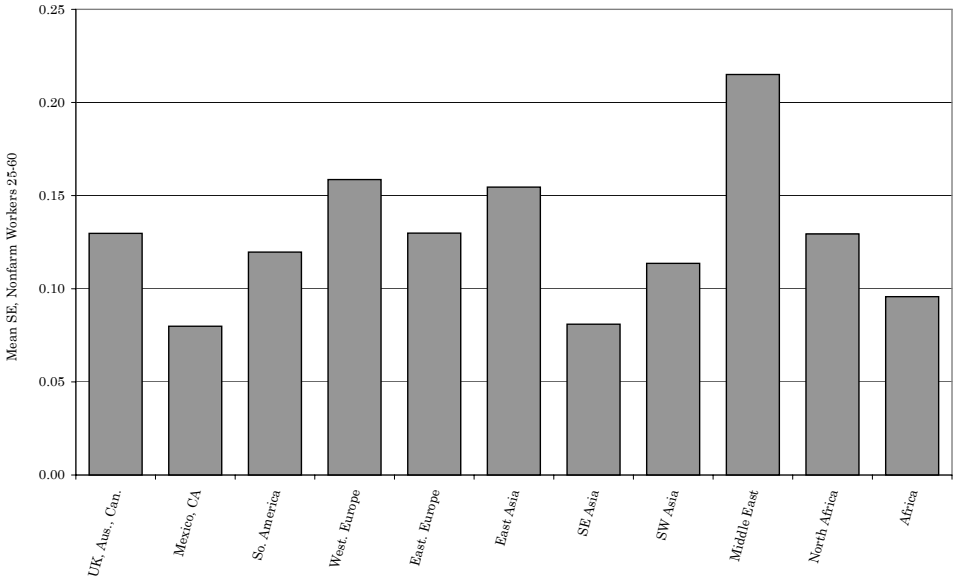

Figure 3.2: Self-Employment by Region, All Immigrants

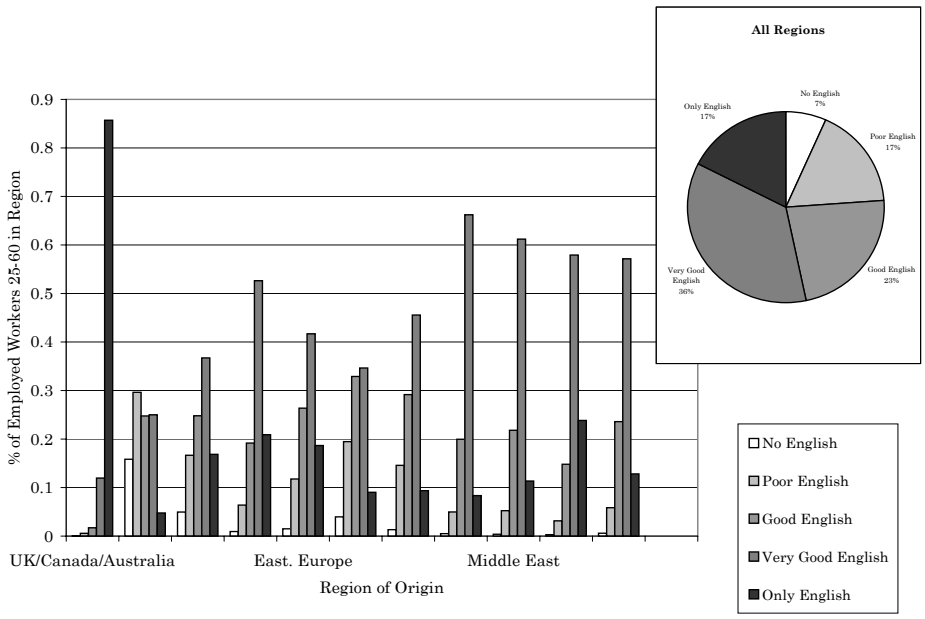

Figure 3.3: Distribution of English Skills Among Workers 25-60 by Region of Birth

Chapter 4

Quality vs. Quantity: The Effect of an Additional Child on Sibling Educational Progress

4.1 Introduction and Background

High fertility has long been associated with lower educational attainment. Cross-sectional and panel microdata from many countries show that families with more children tend to invest less per child on average and have children with lower educational attainment. Along the development path of most countries, the average level of education is observed to increase as total fertility decreases. Across countries, the average level of education is inversely correlated with the average fertility rate.

In the economics literature, this inverse relationship between fertility and education is often explained as a tradeoff between the quantity and quality of children. Investments of time and resources improve the quality of children, but this quality is costly. Thus, having a given quantity of children is more costly the higher the desired quality for each child. Becker and Lewis (1973) formalized this model of the quality-quantity tradeoff, showing how increasing child quantity increases the shadow price of child quality and increasing child quality increases the shadow price of child quantity.

The quality-quantity tradeoff is not the only way the empirical evidence can be explained. Caring for children is relatively more expensive compared to other uses of time for more educated women, so all else equal they can be expected to have fewer children in the context of a home production model. Since mother's education is likely to be positively correlated with children's education,[1] this could also result in the observed relationship.

Parents may also overinvest in children if they have few, if there is uncertainty about the outcome from a given set of inputs, and if there is a certain minimal level of final offspring quality desired. For example, parents may care not about the average quality of each child, but about having at least one child survive to adulthood with enough education to secure a good job. On a more mechanistic level, more educated women are also likely to marry and begin having children at an older age. Apart from any economic considerations, this will tend to reduce family size on average because of a shorter child-bearing horizon.

Understanding the relationship between total fertility and children's education is important for development policy. Investment in human capital has widely seen as promoting growth (Krueger and Lindahl, 2001). If decreased fertility increases educational attainment on its own, a family-planning pol-

[1]There are many reasons mother's education might be highly correlated with children's education. Women with a high level of education themselves are more likely to value education for their children, may be more efficient in providing education (Behrman et al. (1994)), and are likely to live in communities with more resources available for education (Montgomery, Kuenning and Mete, (2000)).

icy may have greater importance in a wider development agenda. Rosenzweig and Wolpin (1980a), for example, present their finding that additional children decrease siblings' education as a possible argument for family planning. Ahn et al. (1998) notes that the Vietnamese government justifies its policies to lower fertility in part by the expectation that lower fertility will increase children's education. If the quality-quantity tradeoffs are not an important part of education decisions, then lowering family size without changing other family attitudes will not lead to increased education. Apart from population policy, understanding how family structure influences educational outcomes may help policy makers in promoting education through developing targeted interventions.

It is difficult to differentiate between quality-quantity tradeoffs and other factors which might lead to lower education in large families. Standard OLS regression of child education on family size will produce biased coefficients because of the endogeneity of the number of children. Including controls for the value of the mother's time outside of the household, such as her own education or predicted wage, partly controls for alternative explanations, but does not completely account for underlying preferences or the possible joint determination of number of children and average child education.

Most empirical studies have taken this approach. Generally, these studies find a negative effect of the number of siblings on education (Kessler, (1991)), but some find no result or qualified results. Kessler (1991) finds no evidence that the number of siblings influences wage levels or growth in

the US. Ahn et al (1998) find that the number of siblings affects educational attainment in Vietnam only for the largest families (those with five or more children). They find a negative effect of family size on school attendance, leading to the conclusion that additional children may interrupt their siblings' education but that the children eventually catch up. Marteleto's (2001) results also indicate a negative effect on enrollment and achievement only at the largest family sizes. Grawe (2003a) finds that young children with more siblings have lower development indicators, but it is unclear which, if any, controls are included.

Given the prominence of the fertility-education debate in the development literature, relatively few researchers have examined the empirical effect of an exogenous child on sibling's education. Rosenzweig and Wolpin (1980a) use twins to examine the quantity-quality tradeoff in India, concluding that an exogenous child decreases education both for the twins themselves and for their siblings by about the same amount. Lee (2004) uses the birth of a daughter in the first birth as an IV to analyze the effect of family size on parent's investment in children's education in Korea, and concludes the opposite: that additional children have no impact on siblings' education, and that observed differences are due to high covariance between tastes for education and tastes for a small family.

This chapter uses the birth of twins as a natural experiment to test if additional siblings have a negative effect on child education levels apart from any underlying preferences about education or family size. The birth of twins

in a given pregnancy is a shock to the number of children in the household which is uncorrelated with families' preferences for children or education or the relative value of time spent in market versus home production. Therefore, it presents a good instrument for the number of children in the household. The approach is similar to that used by Rosenzweig and Wolpin (1980a).

Mexico is an interesting case for such an analysis. Fertility behavior has changed rapidly in Mexico since 1970, resulting in a decrease from a total fertility rate of 7 children per woman in 1960 to 2.4 children in 2002. At the same time, the labor force participation of Mexican women has increased dramatically, with many jobs for women now entailing relatively skilled work. Primary education is virtually universally available in Mexico, while secondary education, which has been compulsory until age 15 in Mexico since 1992, is available in almost all urban areas. Thus, Mexico is a very different case from India, which was studied by Rosenzweig and Wolpin (1980a). However, Mexico remains relatively more traditional in family roles than the U.S. and Western Europe, with larger family sizes, greater gender specialization, less education, and lower average incomes.

In addition to expanding the work of other researchers on the quality-quantity tradeoff by presenting additional empirical evidence, this paper presents several innovations. The relatively large sample of twins enables the examination of two specific questions on how additional siblings might effect children's education. First, do closely spaced siblings hurt children's education? If children are competing for resources in families with budget constraints, then a

closely spaced child would be expected to have a greater impact. Second, do additional young children adversely effect older sisters? Since girls take on more responsibility for household chores, including child care, additional children might effect them disproportionately. Women's education has a greater impact on children's education and on reduced fertility. Thus, reducing fertility might be especially valuable in the long run if it had a positive effect on girls' education. Alternatively, ways might be sought to provide helping girls with many siblings.

4.2 Methodology

The general methodology is to use the birth of twins to instrument for the total number of children in the household. If the quality-quantity model is correct, an additional child should increase the shadow price of child quality and lead to a decrease in the both investment in children's education and in average educational levels of children in the household. I consider three separate measures of average family child quality: educational attainment, educational progress, and weekly study hours.

Educational attainment is a measure of a quality output, and thus provides a different approach than looking at investment into education, which is a quality input. Focusing on attainment takes into consideration the impact of a wide variety of inputs to quality. In addition to monetary resources, parents also invest their time and energy. More indirect investments, such as a peaceful home environment, space to study, expenditures on health care and

safety, and location next to a school are also aspects of investment in child quality which may be constrained by the addition of children to the family. Children may also provide positive or negative spill overs to each other.

Educational attainment is a stock variable which depends on the entire path of a child's education progress. It is difficult to determine whether poor educational attainment is due to late entry into school or to lagging at a later age. The panel nature of the data provides a measure of a flow indicator of child quality: average educational progress. This is the average change in education from the first interview to the last interview. For children who are in the sample at least a year, the level of education should increase by one year if they are attending school and pass. the sample to those who are interviewed a maximum of 12-15 months apart, Including children who are in the sample 12-15 months implies that children progressing at the planned rate should have one year's more education at the end of their participation in the survey than they did at the beginning.

Hours of study time per week provides a measure of investment in education, or a quality input. Parents' investment in children's education is usually measured by monetary expenditures for school fees, supplies, and other goods necessary for education. However, in the context of a country where even young children may help out in the house or in income-generating activities, children's time itself represents one aspect of investment in education. Because it is a flow variable (unlike educational attainment, which is a stock), it can capture more clearly differences in the effects of a sibling at different ages.

4.2.1 Data

The data are the Mexican government's National Survey of Urban Employment (*Encuesta Nacional de Empleo Urbano*, or ENEU) from 1994 to 1999. This is a quarterly household survey that interviews approximately 100,000 households in urban areas of Mexico every quarter. Urban areas are defined as those with more than 2,500 residents. The survey provides representation for 95% of the population in cities with a population over 100,000. Households are in the survey for five periods for a total period of up to 15 months. Basic demographic and educational information is collected on every member of the household, and more detailed information on household members over twelve. School years are recorded in the data for children six and up, and study hours per week for children 12 and older.

Twins are identified by matching children who live in the same household and have the same age, place of birth, and relationship to household head. To ensure that the children are not closely-spaced singletons, all children must be in the sample a minimum of three interviews. Triplets and higher multiple births and families with multiple twins are excluded from the analysis.

The unit of analysis is a family unit of parents and their own children. There may be several related families living in one household, all of which are treated separately. I select families who have all children living at home, no married children or grandchildren, and no more children than the mother

has given birth to[2]. In extended households with multiple adults/couples with children, I match parents to children where possible and count each group as a separate family. To minimize the risk of selection, I limit the sample to families whose oldest child is 18 years or younger. A small number of families where the mother was less than 15 at the time of her first birth are also excluded. Finally, only families who have a mother present are included.

4.2.2 Use of Twins as an Instrument

While the birth of twins in a given birth is exogenous, the overall number of twins in a family is not. Women who have more pregnancies have more opportunities to have a set of twins, which means that the overall incidence of twins in the family is correlated with desired family size. The twins instrument must therefore represent the birth of twins in a given pregnancy or set of pregnancies.

One way to do this is to look only at the birth of twins in the first birth (the "twins-first" IV or *Twins-1*). This instrument is desirable because it can be used to analyze the effect of a marginal child for all women who have had at least one child, and has been the most widely used twins instrument. Rosenzweig and Wolpin (1980b) use the twins-first IV to examine women's life-cycle labor supply, Grogger and Bronars (1994) to examine the relationship between welfare benefits and the marriage and fertility of unwed mothers, and Jacobsen, Pearce, and Rosenbloom (1999) to examine parents' labor supply.

[2]Such children might be stepchildren or adopted children.

However, the twins-first IV is problematic for the Mexican case because women are able to adjust fertility. Most women in Mexico who have children have more than one — only 6% of women in the full sample on households without a twin birth (women with at least one child between the ages of 6 and 18) have only one child. Families who have twins in the first birth are able to completely adjust fertility. Column I of Table 4.1 summarizes the number of additional children, on average, in households which had twins in the first birth compared to households which had singletons by the age of the first child. Twin families have only .36 more children in the household when the child is 7 years old, and there is no significant difference by the time the child is 9 years old. There are actually slightly fewer children in twins-first households by the time the child passes 15 (probably because older women are more likely to have twins). Thus, the incidence of a twin in the first birth is best seen as a shock to the spacing of children rather than as a shock to family size.

A simple alternative is to use twins born in the first two or three births, which restricts the representative sample of the results to families who have had at least two and at least three births. The *Twins-1-2* and *Twins-1-2-3* variables are equal to one if the mother has twins in the first or second or first three births, respectively. Families in these households also adjust fertility over time, so that the difference between the average number of children in a family with twins and that of a family without twins is less than one. Families with a twin in the *Twins-1-2* sample have on average .38 more children than those that do not(Table 4.1, Column 2), while families with twins in the *Twins-1-2-3*

sample have on average .70 more children (Table 4.1 , Column 3). This makes *Twins-1-2* and *Twins-1-2-3* better suited as instruments for overall fertility in this case, although *Twins-1* is still useful for examining the effect of a closely-spaced sibling.

Using these variables means that all marginal effects must be interpreted as the effect of adding an additional child to a family with at least two or three children already. However, the *Twins-1* sample would be similarly restricted. Since the analysis examines the education of *siblings* of twins, only households with two or more births can be included to ensure comparability.

For the specifications which consider the effect of an additional child on a specific sibling, I use variables which indicate the birth of twins in a specific birth. The *Twins-2* variable is defined for women with at least two births and is equal to one for women who have twins in the second birth, and the *Twins-3* is defined for all women with at least three births and is equal to one for women with twins in the third birth.

Results differ for the IVs which include households with at least two children (*Twins-1-2* and *Twins-2*) and those which include households with at least three children (*Twins-1-2-3* and *Twins-3*). However, there is little substantial difference between the coefficients and standard errors of the *Twins-1-2* and *Twins-2* and the *Twins-1-2-3* and the *Twins-3* variables. The advantage of the *Twins-1-2* and the *Twins-1-2-3* specifications is that the sample size is larger. However, the *Twins-2* and *Twins-3* allows birth rank to be controlled for and are easier to interpret.

4.3 Model

The specification of interest is

$$Q = \alpha_1 + \beta_1^*(CHILDREN) + X'\gamma + \epsilon$$

where Q is the measure of average family child quality and $CHILDREN$ is the total number of children born in the family. Since $CHILDREN$ is assumed to be endogenous, the twin instruments described above are use to instrument for it.

The measures for Q are the average adjusted education and average educational progress of all non-twin children in the household and average adjusted weekly study hours of non-twin children 12-15. This follows Rosenzweig and Wolpin (1980a), who conducted a similar analysis using educational attainment. Twins themselves are excluded from the analysis because they may have other health or developmental problems which influence their educational progress apart from family size. The sample is already restricted to households with 2 or more births, so there are no problems of comparability.

To compare children of different ages, education and study hours are adjusted by age and state of residence. Adjustment for state of residence serves to control for any differences in twinning rates between states. Thus, adjusted education $ADJED_i$ is defined for each child i as

$$ADJED_i = EDU_i/AVEED_{ac}$$

where EDU_i is years of education successfully completed and $AVEED_{ac}$ is average years of education for all children of season and age a and state of residence c; and adjusted weekly study hours are defined for all children over 12 as

$$ADJSTUDY_i = STUDY_i / AVESTUDY_{ac}$$

with $STUDY_i$ being weekly hours of study and $AVESTUDY_{ac}$ average study hours for all children of the same age and state[3].

Educational progress is the difference between educational attainment in the first and last interviews of the family and is defined for children who are in the sample at least a year, or

$$PROGRESS_i = EDU_{i,t=5} - EDU_{i,t=1}$$

for children in the sample five times and

[3] $AVEED_{ac}$ and $AVESTUDY_{ac}$ are based on all children in the ENEU data set, not the smaller set of households in the sample. Average age is calculated by quarter and season of the interview, so that children observed in the Fall are compared to children of the same quarterly age also interview in the Fall. This provides a more precise measure of educational attainment by age. However, the average education of older children in the sample is higher than in the population at large because of the way the sample is selected. Because the sample includes only children from families with all children present and an oldest child younger than 18, older children in the sample are more likely to come from small families and to be of a lower birth-rank than children in the entire ENEU data set. To make ages comparable, average education is further normalizes by dividing by the average in the sample at each age.

$$PROGRESS_i = EDU_{i,t=4} - EDU_{i,t=1}$$

for children in the sample four times.

The quality variables are then:

$$HH\_ED_j = \frac{\sum_{i=1}^{NT}(ADJED_i)}{NT}$$
$$HH\_STUDY_j = \frac{\sum_{i=1}^{NT}(ADJSTUDY_i)}{NT}$$
$$HH\_PROG_j = \frac{\sum_{i=1}^{NT}(PROGRESS_i)}{NT}$$

for each household j, where NT is the number of children in each family who are not themselves twins.

Because error terms might be correlated for families within the same household, robust standard errors are calculated which account for clustering on the household.

If twins are uncorrelated with other variables that influence average educational attainment, excluding other determinants of child quality will not effect the coefficients on the twins IVs. However, the probability of having a twin is correlated with mother's age and parity. Therefore, the age of the mother at the time of birth is controlled for. Mother's age at birth for the first two and three births respectively for the *Twins-1-2* and *Twins-1-2-3* specifications. The correlation with parity is much smaller and applies mostly to births of larger birth ranks, so it has minimal effect.

4.4 Descriptive Statistics

Table 4.2 gives the numbers of women and total observations in the sample for each instrument used. In the *Twins-1-2* sample, I have multiple observations on 36,098 children from 15,034 families with two or more births. Of these, 1,197 children are the siblings of twins and 1,714 children are themselves twins and are excluded. There are 1,078 twin families in all. For the *Twins-1-2-3* sample, there are 28,789 children in 10,161 families with three or more births. Of these, 1,490 children are the siblings of twins and 1,178 are themselves twins. There are 806 households with twins.

Chart 1 shows average years of educational attainment by age. Educational attainment advances linearly at an average of a little less than a year of education per year of age until age 15, when it slowly begins to fall. This is the maximum age of compulsory education in Mexico, so the decreasing slope represents higher levels of school exits. Chart 2 shows average adjusted education for children 6–18 by family size. Adjusted education is lower for families with more than 5 children, but it appears about the same for other households.

Without controlling for the sample or mothers' age at time of birth, the adjusted education for twins and the siblings of twins appears the same as that of children from families without twins after age 8 (Chart 3). Both twins and twin siblings lag in education between the ages of 6-8, indicating later school enrollment. However, they are able to catch up rapidly, so that by age 8 there is no difference.

4.4.1 Comparison of Twin and Nontwin Families

There are some differences in characteristics of twin and non-twin families. Table 4.3 gives means of relevant variables for all non-twin and twin households over all families in the *Twins-1-2* and *Twins-1-2-3* samples. Twin families have more children on average, but less that one additional child more: families in the *Twins-1-2* sample have on average only .37 more children, and families in the *Twins-1-2-3* sample have .67 more children than families without twins. Mothers of twins are a little more than half a year older than other mothers on average, and begin having children later. The age at first birth is over a year later in the Twin-1-2 sample. Both the mothers and fathers of twins have slightly more education, and twin households have higher average real income.

Twin families also differ in some ways related to child spacing and sex ratio. Child spacing is closer in twin families. There is an average of 6.8 and 8.2 years difference between the oldest and youngest child in non-twin families, compared with 5.6 and 7.8 years for twin families. Twin families are somewhat more likely to have a girl born in the first pregnancy. The sibling sex ratio on average is about the same over all twin and non-twin families, but twin families are more likely to have more children of the same sex, because some twin births are identical twins.

4.4.2 Are Twin Births Exogenous?

For twins to be a valid instrument, there must be no covariance between the birth of twins and the error term. The differences between the twin and non-twin samples raise the question of whether twins are truly exogenous. If parents of twins have more education or income than parents of non-twins after controlling for mother's age at time of birth, then twins are not a valid instrument. I run several regressions to check the correlation between variables that impact education that might also be correlated with having a twin. After including mother's age at the time of birth, parents' education and income are not significant predictors of having a twin.

4.5 Results

4.5.1 Household Average Adjusted Education

An additional child decreases sibling's education attainment, as shown in Column 1 of Table 4.4[4]. For the sample of children age 6–18, having an additional child decreases education by about 9.4-11.2%. However, when separate regressions are run by age, only younger children are affected. The education of children 6–11 is decreased by 17.1–17.9%, but there is no significant effect at older ages. Coefficients for the *Twins-1-2* specification are actually positive,

[4]In preliminary regressions on the average household adjusted education of all children in the family, including twins, I find children from twin families have significantly less average education. When the sample is restricted to households with 2 or more births, however, the results are significant only for the *Twins-1-2-3* sample and are not significant for older children. The results excluding twins themselves are only slightly smaller.

although insignificant.

Coefficients on other measures of quality are also mostly positive and insignificant. For study hours, there is no significance at all. For average educational progress, the T-statistics approach one in the overall sample. This would indicate that children in families with an additional child actually progress more quickly. In separate regressions with children under 7 removed from the analysis, twin siblings had no significant effect on average education. It appears an additional child effect siblings mostly by delaying the start of school, but that afterwards lagging childen progress through school more quickly so that there is no observed effect of an additional sibling at older ages.

The way the sample is selected leads to two possible problems which would tend to bias the coefficient on the twins IV and might mask a negative effect of additional children on older siblings. Because the sample is comprised of families with no children over 18 and all children at home, older children in particular are predominantly those with a lower birth order and children from smaller families. Additional children may have a negative effect primarily on children of higher birth ranks or in larger families, who tend to be younger in this sample because of the way the sample is constructed.

Second, the way the data is constructed would exacerbate any selection bias resulting from the faster exit of older siblings of twins from the household. If siblings of twins in poorer quality households are more likely to leave the family, than there is positive selection of twins into the sample and education in households with twins will be overestimated.

To check this, regressions are run on a sample which is not restricted to households with all children present. Children's birth rank is assigned by the number of live births the mother has had, assuming that all children remaining in the household are the natural children of the woman identified as the mother and that oldest children leave the household first. This lessens selection issues for younger children and allows for representation of children of higher birth ranks at older ages. The results, however, are virtually the same. A positive coefficient is still found for children 12-18 in the *Twins-1-2* sample. There are no significant results for older children in any of the alternative specifications of these samples.

The pattern reflected in the IV estimates is different from that obtained from naïve OLS estimates, indicating that estimates based on OLS may be endogenous (See Table 4.5). For all households with 2 or more children and no twins, each additional child decreases education only for children 12-18. The age of the additional child does not matter. This is consistent with households which choose more children having lower educational targets and children who exit school at a younger age, which is the opposite of the twins results.

4.5.2 Individual Specification

The quality-quantity model assumes that parents seek a target level of average education per child. However, it may be that parents favor some children over others, or that the effect of an additional sibling depends on child spacing or the relative age of children. Children are likely to have different

requirements at different ages for constrained resources such as parental attention, so that siblings with close ages may compete for resources more and younger children may have a larger impact on other siblings.

Hanushek (1992) finds that the number of children is important for educational progress, and that birth order and spacing are not important. However, he looks at the number of young children in the household at any given time, not total fertility. In this context, he finds that first and last born children have an advantage because they spend more time in the household without siblings (who have not been born yet or who have already grown out of childhood).

The twins experiment can also illuminate this topic. The birth of a twin can be used to examine the effect of an additional sibling within a given age range. I use regressions of individual children's adjusted education on whether or not they have a twin sibling and mother's age at time of birth of the twin, as controlled for above. I use the same twin instrument samples as above.

4.5.3 Do Closely Spaced Siblings Lower Schooling?

If siblings compete for resources within the family, it seems intuitive that children with additional close siblings might be disadvantaged in education. One of the most important resources for young children is parental time, which is by its nature a limited resource.

OLS regressions on children from households without twins show that the age distance between siblings matters for educational attainment (Table

4.6). Among all children 6–11 who have older siblings, an additional year in age from the next older sibling increases education by approximately 3.4%. The effect persists for older children, who have an average increase of 2.2% for each additional year between them and an older sibling. The age difference between a child and the next younger sibling does not seem as important. There are small negative coefficients for children 6–11, and significant positive coefficients for children 12-15 suggesting an increase of .2-.3% in education for each year in difference of age. An interesting pattern is observed for children 6–11 — having more age from an older sibling has a large positive effect, while having more age from a younger sibling has a significant negative effect. The effect is particularly strong and significant for girls. For children with both a younger and an older sibling, the coefficients are similar but have lower significance levels.

Results are similar when the effect is measured by indicator variables for having siblings less than 2 years older or younger (See Table 4.8). A close older sibling has a negative effect on education for all age groups and both boys and girls (compared to all children with an older sibling). Having a close younger sibling is associated with more education for young children, and less education for boys 12-15.

The positive coefficients on age distance between the next older child fits a story where children compete for resources. It could be that the older child wins out, on average, in this competition, so that younger children are not as much of a threat. For older children, having a closely spaced children is

preferable to having a much younger sibling, who may receive more parental attention.

Twins can be taken as a shock to child spacing in addition to as a shock to the total number of children. This would also offer an alternative explanation for why twins themselves lag behind when they are younger - they have no age distance between themselves, so they are competing for resources throughout childhood.[5]

I take subsamples of all children with siblings born either two years or less earlier or two years or less later and run a regression with an indicator variable for whether or not the next oldest birth or younger birth was twins. The independent variable is the child's own adjusted education, adjusted study hours, and educational progress.

As expected, the effects of a close sibling are stronger than the effects of an additional sibling in the overall sample (Table 4.7). Having a close twin is associated with a drop in educational attainment of 8.4-14.1%. Educational progress is 10.7-16.6% lower for all children. However, again, there is no effect for older children. The sign of the coefficients varies by sample and significance levels are low. Separating the sample to look specifically in the effect of older and younger twins results in small sample sizes. While there is a negative

[5]Closely spaced children also "compete" for the physical health resources of the mother, in the sense that close births sap the mother's health. There is some literature which shows that low birth weight varies by month due to differences in maternal nutrition, and that low birth weight can predict health outcomes at older ages. Thus, younger siblings who are born soon after an older sibling may be disadvantaged even before birth.

effect of close older and younger twins on education progress for children 6–11, for older children some coefficients are significant, there is no clear pattern: some samples show significant negative effect of an additional sibling, and some significant positive effects.

4.5.4 Do Younger Siblings Draw Girls from School?

Much attention has been paid to the possibility that younger siblings take time away from girls' studies. Marteleto (2001) explicitly examines this issue in her study of Brazil. Since girls might be expected to have more responsibilities in the home, it might be that unplanned children increase demands on girls' time in the home, and have a larger negative effect on their education compared to that of boys. Although additional children will most likely create additional demand both for housework and for market work, it is usually assumed that the relative value of time in the home will increase[6], which would draw girls into housework since they have a comparative advantage.

If this were the case, additional younger siblings would tend to decrease the educational attainment of girls more than boys, if demands on girls to work in the home are greater than demands on boys to leave school and work. Also, older girls would be negatively affected by the presence of children under school age in the household.

[6]A wide body of literature has shown that additional children increase women's work in the home and decrease women's work in the market but have a minimal effect on men's time use, if any. This is discussed in more detail in Chapter 2 of this thesis

Table 4.10 shows the effect of having a younger twin sibling on years of schooling greater for girls aged 6–11 than for boys in for households with at least three children, but not for households with at least two children.

Simple OLS regression (Table 4.11)shows that the naive effect of having a sibling under 6 years of age depends on age. Neither girls nor boys with a younger sibling under 6 years of age have significantly fewer years of schooling, compared to other children with a younger sibling. However, children with a sibling younger than 6 do have significantly slower educational progress than children with a younger sibling older than 5. For older girls, having a younger sibling less than 5 is associated with fewer years of schooling, less time devoted to study, and slower educational progress. Boys have fewer years of schooling but a positive effect on study hours. Having a sibling less than 6 years old compared to children with any younger sibling has an insignificant positive effect on boys and girls 6–11, but a significant negative effect for boys and girls 12–18.

For boys, the negative effect is due to the fact that older children with a sibling under 6 years old have more younger siblings. When the total number of children in the family is accounted for, boys actually have more educational attainment. Older girls, however, have 4.5% less study hours and less years of schooling even when the total number of children in the household is controlled for.

Comparing children with a twin younger than 6 years of age to children with a singleton birth younger than 6 years of age treats the twin instrument

both as a shock both to the total number of young children in the household and a shock to the total number of children in the household. For younger children, years of schooling is less, but educational progress is greater, indicating that children are catching up. There is no effect for older girls, and a positive effect on older boys. The fact that this result is observed only in the *Twins-2* sample suggests that this result may be an anomaly: families with this wide of a spread between the first and second born are atypical for Mexico. There is no significant effect on study hours.

These results indicate that girls 6–11 are hurt by having an additional younger sibling 0-11 years younger, regardless of whether the total number of children is controlled for. However, they are catching up quickly, suggesting again that lower schooling might be because of delayed entry into school. If there is a benefit to having a younger sibling (for example, mothers might spend more time at home), it does not help girls.

4.5.5 Selection Issues

As children get older, there is an increasing tendency for them to exit the household into marriage or migration. Children exiting the household are usually exiting schooling as well. Thus, there may be a selection problem that gets worse as children age. There is evidence that 'poorer quality' children exit at a faster rate than better quality children. In the larger ENEU data set, children aged 18 who do not live with their parents have 8.27 years of education, while children who live with their parents have a mean education

level of 9.11 years. Married 18 year olds have a mean education of only 7.45 years, compared to a mean education of 9.11 years for nonmarried 18 year olds.

If children from twin and non-twin families exit at the same rate, the mean education will be biased up for the remaining families, but the difference between twin families and non-twin families will not. There is a more substantial problem if twins or their siblings exit the household at a faster rate than children from non-twin households. If the pool of twins is selected to higher quality as the oldest child ages, any negative effect of twins will be dampened, and twins may appear to have a spurious positive effect on education. This selection problem would be most severe among older older children, but would affects all children with older siblings, since the entire household is removed from the family if one child is absent. This could explain the absence of an effect of additional siblings for older children.

If the quantity-quality model is correct, than twins would be expected to exit faster. Either early marriage or work might be a response to budget constraints caused by additional children. Parish (1993) finds some evidence from Taiwan that girls who have more siblings marry earlier. Even if this is not the case, households with more children simply have a greater probability that at least one of them will leave the family.

If selection is a problem, then the percent of the sample that is in twin families should decrease as the age of the oldest child in the family increases. I run a regression with an indicator variable for households with the oldest child

older than 15 years old. For Twins-1-2 and twins-2, there are significantly fewer children in households with twins with the oldest child older than 15 years old. If this is due to twins exiting faster, the result is that the education of twin families is overestimated in households with older children. However, I find no correlation between the exit older siblings and the presence of a twin among younger siblings.

Exit from the household begins well before age 18. It appears to be more of a problem after age 15, and that girls exit faster than boys. At age 15, .4% of boys and 3.9% of girls are married; by age 16, 1% of boys and 8.6% of girls in the overall sample are married. Without data which follows children after they leave the family, there is no way to correct the selection bias if it exists. Therefore, the results for older children, and particularly children 16–18, must be treated with suspicion.

4.6 Discussion

These results do not lend convincing support to the quality-quantity model. Additional children have a negative effect on the average education of siblings, but only in the younger age group. For children 6–11 years of age, an additional sibling reduces years of schooling by 17.1–17.9%. The effect on school progress, however, is ambivalent, and appears positive in the sample of larger families. No effect is noticed for older children on years of schooling, weekly study hours, or the advancement rate. Because the result depends strongly on including children 7 and under in the sample, it appears as if the

primary effect of additional children is on delaying entry into school. No or little effect is noticed at later ages.

The positive coefficients on school progress, although not significant, suggest that children who lag behind because of an additional sibling begin catching up even at younger ages. How they are able to catch up is not clear. After age 15, children may catch up by continuing education as others begin to drop out. For younger children, there is no information on additional investments in education, such as additional tutoring, study time, or summer school, which might enable them to catch up.

However, the results also cannot be used to disprove the statement that additional children lower their siblings' education. There are several possible sources of bias which would tend to bias the education of siblings of twins upwards or towards zero, particularly for older children.

One drawback is that the quality of education is not controlled for, introducing measurement error. Years of completed education is at best a proxy for child quality. This will tend to bias the results toward zero. Parents may substitute public education for private education when there is a shock to family size. Children with many siblings may fall further down in their class or be directed to weaker classes and programs. If there is an institutional reluctance to fail marginal students, then completed years of schooling would be a weak measure of total education. Arguably, there are larger differences in quality after age 15. The educational measure, however, does not distinguish between college-track courses and technical schools which may have different

qualities. It also does not track children into higher education.

Positive selection of twins into the family could result if additional siblings led to pressure for children with a weaker attachment to school to exit the household early.

Finally, the restriction to households with children only in the 6–18 age range, while necessary to control for selection, creates its own problems. Children I observe over the age of 15 are more likely to be first-born and to be in smaller families. The evidence seems shows that younger children are more affected by a larger family. There might be more of an effect if more children born in later births were observed in secondary school.

These factors could have influenced the weak evidence for a positive effect of additional siblings found for older boys. However, these positive effects could be plausible. Several studies have found a positive impact of other siblings on education (Marteleto (2001)). Psacharopoulos and Arriagada (1989) find that, while there was a negative effect of total siblings on average education, there was a positive effect of siblings of school age. Several explanations are consistent with this finding. There could be positive spill overs from additional children, although it is unclear how a younger child would help an older sibling. Alternatively, economies of scale could lower the cost of schooling for each child. Children with twin siblings are also less likely to have very young children in the household.

Parish (1993) hypothesizes that younger children benefit from having

older siblings who can provide assistance and additional resources. This implies that older children are hurt by an additional child. However, here the older girls seem to have no negative effect from having younger children in the household, and older boys actually appear to benefit.

It may be that an additional young child lowers the per-capita cost per child of spending time in the home relative to other activities, and leads to an increase in the amount of total time the mother spends in the house. If mothers and daughters are substitutes in terms of work in the house, having an older daughter may enable the mother to work more even if she has a young child, while having an older son would not. However, while the OLS results indicated than older girls are hurt by young siblings, the twins regressions showed no effect.

Following this line of reasoning, one interpretation of delayed school entry may be that mothers who are staying at home anyway feel less pressure to put children in school early. If children who start school late are learning at home, it is not clear that this is a disadvantage in terms of long-term educational attainment.

4.7 Conclusion

This chapter has examined the effect of an additional sibling on children's education. A twins experiment is used to separate the effect of number of children on children's education from other factors on which may be correlated with both family size and children's education. Education is adjusted by

age and state of residence so that children of different ages can be compared.

Additional siblings have a significant negative impact only on the average education of younger children. Afterwards, children catch up. There is no clear negative effect on educational progress. For older children, an additional child has no clear effect, and is associated with positive coefficients for some specifications with boys.

Closely spaced siblings have a larger negative effect. There is evidence that a girl's education is hurt more than a boy's by an additional younger sibling in a family with at least three children. In addition, for girls 12-18 there is no negative effect from having a set of twin siblings under the age of 5 in the household, compared to similar girls with a singleton sibling under the age of 5.

The general pattern of children lagging behind in education in response to an additional sibling when young but then catching up contrasts with the naïve OLS results, which show that additional children primarily effect only older children. This indicates that families' educational targets do not change when they have an additional child. Rather, the observed negative relationship between additional siblings and education in this sample is due to covariance between parents' preference for large families and their educational goals.

A natural extension of this paper would be to more closely examine the role of small children in changing the public time of parents available to all children in the household, and how this affects education. Does a longer presence

of the mother in the household explain delayed school entry for young children? If so, if does this help or hinder their development? Ideally, more precise measures of educational progress would show short-term effects of additional siblings at different stages of childhood. It is also important to understand how children who lag in early education are able to catch up, and whether they truly catch up or if the inability to distinguish quality of education is masking continuing lags.

Table 4.1: Difference in Mean Fertility by Age of First Child

Age of	Twins-1		Twins-1-2		Twins-1-2-3	
1st Child	Mean Dif.	(SE)	Mean Dif.	(SE)	Mean Dif.	(SE)
6	0.246	(0.085)	0.833	(0.057)	0.869	(0.047)
7	0.511	(0.117)	0.705	(0.057)	0.893	(0.097)
8	0.393	(0.107)	0.627	(0.061)	0.908	(0.078)
9	0.307	(0.155)	0.723	(0.080)	0.878	(0.069)
10	0.173	(0.133)	0.502	(0.075)	0.925	(0.080)
11	-0.071	(0.130)	0.338	(0.078)	0.770	(0.070)
12	-0.155	(0.121)	0.239	(0.075)	0.795	(0.091)
13	-0.107	(0.141)	0.184	(0.072)	0.569	(0.074)
14	0.372	(0.196)	0.511	(0.108)	0.724	(0.091)
15	-0.332	(0.156)	0.370	(0.122)	0.671	(0.109)
16	-0.374	(0.167)	0.039	(0.105)	0.399	(0.084)
17	-0.129	(0.236)	0.314	(0.144)	0.586	(0.111)
18	-0.248	(0.204)	0.150	(0.104)	0.533	(0.086)
Total	0.001	(0.042)	0.383	(0.026)	0.696	(0.026)

Table 4.2: Sample Sizes

Number of Observations

	Twins-1-2	Twins-1-2-3	Twins-2	Twins-3
Nontwin	133,057	104,542	133,057	104,542
Twin Sibling	4,763	5,959	3,456	3,576
Twin	6,874	4,628	3,798	1,960
Total	144,694	115,129	140,311	110,078

Number of Children

	Twins-1-2	Twins-1-2-3	Twins-2	Twins-3
Nontwin	33,187	26,121	33,187	26,121
Twin Sibling	1,197	1,490	861	883
Twin	1,714	1,178	952	510
Total	36,098	28,789	35,000	27,514

Number of Families

	Twins-1-2	Twins-1-2-3	Twins-2	Twins-3
Nontwin	13,956	9,355	13,956	9,355
Twin	1,078	806	697	438
Total	15,034	10,161	14,653	9,793

Table 4.3: Descriptive Statistics, Households with and Without Twins

	Families in Twins-1-2 Sample			
	Nontwin Families (13,841)		*Twin Families (1,062)*	
Variable	Mean	(Std. Dev.)	Mean	(Std. Dev.)
Number of Children	3.098	(1.104)	3.470	(0.787)
Age, Oldest Child	12.391	(3.754)	11.892	(3.645)
Age, Youngest Child	5.556	(3.745)	6.279	(4.069)
Mother's Age, 1st Birth	21.742	(4.067)	22.909	(4.161)
Mother's Current Age	34.152	(5.382)	34.815	(5.385)
Father's Current Age	37.129	(6.412)	37.487	(6.470)
Mother's Education	7.301	(3.358)	7.764	(3.415)
Father's Education	8.606	(3.591)	9.095	(3.456)
Range of Child Ages	6.835	(3.552)	5.613	(3.307)
% Girls Among Children	0.490	(0.296)	0.505	(0.308)
Father's Real Income	574.2	(817.4)	644.9	(891.6)
Mother's Real Income	172.3	(354.2)	207.2	(367.0)
Total Household Income	818.1	(929.6)	926.3	(1009.2)
Parents Married	0.831	(0.375)	0.830	(0.376)
Common-law Marriage	0.076	(0.264)	0.062	(0.242)

	Families in Twins 1-2-3 Sample			
	Nontwin Families (9,311)		*Twin Families (791)*	
Variable	Mean	(Std. Dev.)	Mean	(Std. Dev.)
Number of Children	3.633	(0.968)	4.321	(0.696)
Age, Oldest Child	13.204	(3.521)	13.197	(3.442)
Age, Youngest Child	5.055	(3.530)	5.437	(3.693)
Mother's Age, 1st Birth	21.172	(3.774)	21.703	(3.751)
Mother's Current Age	34.392	(5.069)	34.920	(5.041)
Father's Current Age	37.520	(6.186)	38.148	(5.973)
Mother's Education	6.910	(3.312)	7.028	(3.314)
Father's Education	8.189	(3.622)	8.326	(3.496)
Range of Child Ages	8.149	(3.286)	7.760	(3.194)
% Girls Among Children	0.492	(0.271)	0.512	(0.275)
Father's Real Income	564.0	(837.3)	560.7	(750.2)
Mother's Real Income	146.2	(295.2)	151.3	(342.2)
Total Household Income	782.8	(925.3)	798.5	(871.6)
Parents Married	0.843	(0.364)	0.845	(0.363)
Common-law Marriage	0.083	(0.277)	0.066	(0.248)

**Based in 12,437 nontwin and 924 twin fathers in* Twins-1-2 *and 8,561 nontwin and 705 twin fathers in* Twins-1-2-3.

Table 4.4: Effect of Twins on Average Family Child Quality Measures

	Ave. Education		Ave. Study Hours		Ave. Educational Progress	
	Twins 1-2	Twins 1-2-3	Twins 1-2	Twins 1-2-3	Twins 1-2	Twins 1-2-3
Children 6-18						
Number of Children	-0.094	-0.112			0.023	0.026
	(0.050)*	(0.028)***			(0.036)	(0.027)
Obs.	11,165	7,488			51,797	35,169
Children 6-11						
Number of Children	-0.171	-0.179			-0.015	0.026
	(0.068)**	(0.047)***			(0.035)	(0.028)
Obs.	10,104	6,911			45,285	31,489
Children 12-18						
Number of Children	0.018	-0.004	0.036	0.025	0.056	0.017
	(0.02)	(0.012)	(0.06)	(0.033)	(0.097)	(0.055)
Obs.	6,414	5,047	33,878	27,067	28,571	22,695
Children 12-15						
Number of Children	0.006	-0.005	-0.009	0.012	0.026	0.041
	(0.019)	(0.012)	(0.046)	(0.031)	(0.076)	(0.056)
Obs.	6,129	4,884	30,752	24,994	26,132	21,109

Controls for mother's age at time of relevant births. Average study hours are per quarter, so families are in the sample multiple times.

Table 4.5: Effect of Additional Child on Adjusted Education (OLS)

	All	6-11	12-18	All	6-11	12-18
Girl	0.047	0.061	0.029	0.047	0.061	0.029
	(0.015)***	(0.025)**	(0.003)***	(0.015)***	(0.025)**	(0.003)***
Mother's Age, 1st Birth	-0.003	-0.008	0.007	0	-0.012	0.009
	(0.005)	(0.008)	(0.001)***	(0.007)	(0.014)	(0.001)***
Mother's Age at Birth	0.01	0.019	-0.003	0.007	0.023	-0.006
	(0.005)**	(0.007)***	(0.001)***	(0.007)	(0.013)*	(0.001)***
Father's Age at Birth	-0.002	-0.002	-0.001	-0.002	-0.002	-0.001
	(0.001)**	(0.001)	(0.000)***	(0.001)**	(0.001)	(0.000)***
Mother's Education	0.006	0.007	0.005	0.006	0.007	0.005
	(0.003)**	(0.005)	(0.001)***	(0.003)**	(0.005)	(0.001)***
Father's Education	0.01	0.012	0.008	0.01	0.011	0.008
	(0.002)***	(0.004)***	(0.000)***	(0.002)***	(0.004)***	(0.000)***
Number of Children	-0.002	0.003	-0.02			
	(0.007)	(0.013)	(0.001)***			
Children 0-5				-0.002	0.028	-0.022
				(0.012)	(0.019)	(0.002)***
Children 6-11				-0.014	-0.021	-0.023
				(0.010)	(0.018)	(0.002)***
Children 12-15				0.016	0.001	-0.016
				(0.010)	(0.026)	(0.002)***
Children 6-18				0.009	-0.019	-0.01
				(0.019)	(0.051)	(0.004)***
Constant	0.728	0.582	0.938	0.73	0.567	0.919
	(0.056)***	(0.098)***	(0.011)***	(0.051)***	(0.088)***	(0.010)***
Observations	133,601	77,643	55,958	133,601	77,643	55,958
R-squared	0	0	0.11	0	0	0.11

Table 4.6: Age Difference to Younger and Older Siblings, OLS Regressions, Educational Attainment

	All	Children 6-11	Children 12-15	Girls 6-11	Girls 12-15	Boys 6-11	Boys 12-15
Yrs. to Younger Sib.	-0.003	-0.009	0.002	-0.013	0.001	-0.005	0.003
	(0.003)	(0.007)	(0.001)***	(0.008)*	(0.001)	(0.011)	(0.001)***
Obs.	107,906	56,139	36,113	27,727	17,817	28,412	18,296
	All	Children 6-11	Children 12-15	Girls 6-11	Girls 12-15	Boys 6-11	Boys 12-15
Yrs. to Older Sib.	0.031	0.034	0.022	0.046	0.024	0.024	0.02
	(0.015)**	(0.017)**	(0.003)***	(0.019)**	(0.004)***	(0.027)	(0.004)***
Obs.	75,674	51,935	20,780	25,352	10,237	26,583	10,543

Table 4.7: Effect of A Close Twin

	Girls								
	Years Education			Weekly Study Hours			Educational Progress		
	Twins-1	Twins-1-2	Twins-1-2-3	Twins-1	Twins-1-2	Twins-1-2-3	Twins-1	Twins-1-2	Twins-1-2-3
Children 6-11									
Has Close Twin	-0.297	-0.263	-0.254				-0.275	-0.124	-0.002
	(0.140)**	(0.066)***	(0.063)***				(0.136)**	(0.074)*	(0.060)
Obs.	10,135	13,919	12,339				10,215	14,017	12,421
Children 12-15									
Has Close Twin	0.028	0.002	-0.002	-0.251	0.01	0.035	-0.007	-0.097	-0.073
	(0.028)	(0.020)	(0.020)	(0.127)**	(0.072)	(0.082)	(0.115)	(0.061)	(0.065)
Obs.	5,698	8,906	8,435	5,698	8,906	8,435	5,698	8,906	8,435

	Boys								
	Years Education			Weekly Study Hours			Educational Progress		
	Twins-1	Twins-1-2	Twins-1-2-3	Twins-1	Twins-1-2	Twins-1-2-3	Twins-1	Twins-1-2	Twins-1-2-3
Children 6-11									
Has Close Twin	-0.314	-0.181	-0.224				-0.025	-0.041	-0.009
	(0.106)***	(0.064)***	(0.079)***				(0.132)	(0.061)	(0.060)
Obs.	10,433	14,241	12,663				10,499	14,335	12,735
Children 12-15									
Has Close Twin	0.019	-0.007	-0.014	0.027	-0.034	-0.049	-0.083	0.091	0.162
	(0.031)	(0.031)	(0.034)	(0.110)	(0.056)	(0.064)	(0.113)	(0.146)	(0.170)
Obs.	5,550	8,620	8,155	5,550	8,620	8,155	5,550	8,620	8,155

Table 4.8: Effect of Close Younger Sibling, OLS

	Years Education			Weekly Study Hours			Educational Progress		
	All	Girls	Boys	All	Girls	Boys	All	Girls	Boys
Children 6-18									
Close Young. Sib.	0.003	0.01	-0.004				0	0.035	-0.034
	(0.009)	(0.013)	(0.011)				(0.011)	(0.016)**	(0.015)**
Obs.	81,031	39,568	41,463				81,040	39,572	41,468
Children 6-11									
	0.022	0.029	0.014				-0.021	-0.008	-0.033
	(0.018)	(0.028)	(0.023)				(0.011)*	(0.015)	(0.015)**
Obs.	31,414	15,431	15,983				31,422	15,434	15,988
Children 12-15									
	-0.006	0.002	-0.014	-0.019	-0.007	-0.031	0.011	0.043	-0.021
	(0.004)	(0.005)	(0.006)**	(0.010)*	(0.015)	(0.015)**	(0.017)	(0.024)*	(0.024)
Obs.	34,144	16,759	17,385	34,138	16,757	17,381	34,144	16,759	17,385

Table 4.9: Effect of Close Older Sibling, OLS

	Years Education			Weekly Study Hours			Educational Progress		
	All	Girls	Boys	All	Girls	Boys	All	Girls	Boys
Children 6-18									
Close Old. Sib.	-0.055	-0.067	-0.043				-0.007	0.006	-0.02
	(0.017)***	(0.027)**	(0.021)**				(0.010)	(0.014)	(0.014)
Obs.	76,359	37,273	39,086				76,858	37,545	39,313
Children 6-11									
Close Old. Sib.	-0.086	-0.099	-0.075				0.001	0.005	-0.004
	(0.026)***	(0.041)**	(0.032)**				(0.011)	(0.016)	(0.015)
Obs.	52,607	25,685	26,922				53,106	25,957	27,149
Children 12-15									
Close Old. Sib.	-0.026	-0.032	-0.021	-0.006	-0.012	0.001	-0.014	0.008	-0.037
	(0.005)***	(0.008)***	(0.008)***	(0.013)	(0.019)	(0.019)	(0.020)	(0.026)	(0.030)
Obs.	20,790	10,241	10,549	20,788	10,241	10,547	20,790	10,241	10,549

Table 4.10: Effect of A Younger Sibling by Gender

	6-18 Year Olds		*6-11 Year Olds*		*12-18 Year Olds*	
	Twins-2	Twins-3	Twins-2	Twins-3	Twins-2	Twins-3
Twin Sibling	-0.023	0.023	-0.051	0.051	0.015	0
	(0.023)	(0.026)	(0.040)	(0.055)	(0.012)	(0.012)
Girl*Twin Sib	0.007	-0.075	0.014	-0.148	-0.012	-0.012
	(0.035)	(0.033)**	(0.070)	(0.068**)	(0.018)	(0.017)
Girl	0.031	0.034	0.039	0.041	0.026	0.028
	(0.010)***	(0.008)***	(0.021*)	(0.018**)	(0.004***)	(0.003***)
Obs.	59,781	75,447	26,509	33,678	33,272	41,769
R2	0	0	0	0	0.03	0.04

Table 4.11: Effect of a Sibling<6, OLS

	Years Education			Weekly Study Hours			Educational Progress		
	All	Girls	Boys	All	Girls	Boys	All	Girls	Boys
Children 6-18									
Has Sib. <6	-0.03	-0.024	-0.035				-0.143	-0.151	-0.135
	(0.012)**	(0.017)	(0.017)**				(0.011)***	(0.015)***	(0.015)***
Obs.	109,627	53,805	55,822				20,154	9,917	10,237
Children 6-11									
Has Sib. <6	0.001	0.006	-0.005				-0.191	-0.194	-0.187
	(0.023)	(0.029)	(0.034)				(0.011)***	(0.015)***	(0.016)***
Obs.	57,758	28,479	29,279				11,035	5,451	5,584
Children 12-15									
Has Sib. <6	-0.014	-0.016	-0.012	-0.008	-0.041	0.025	-0.021	-0.011	-0.033
	(0.003)***	(0.005)***	(0.005)**	(0.012)	(0.018)**	(0.017)	(0.019)	(0.026)	(0.025)
Obs.	36,208	17,863	18,345	24,251	12,107	12,144	6,525	3,222	3,303
Children 12-18									
Has Sib. <6	-0.023	-0.028	-0.018	-0.001	-0.045	0.041	-0.038	-0.052	-0.026
	(0.003)***	(0.004)***	(0.004)***	(0.012)	(0.017)***	(0.016)**	(0.019)**	(0.026)**	(0.026)
Obs.	51,869	25,326	26,543	38,583	18,969	19,614	9,119	4,466	4,653

All regressors found in OLS regression except $NumberofChildren$ also included.

Table 4.12: Effect of Having a Twin Sibling <6

Girls

	Years Education		Weekly Study Hours		Educational Progress	
	Twins-2	Twins-3	Twins-2	Twins-3	Twins-2	Twins-3
Children 6-18						
Has Twin Sib. <6	-0.037	-0.132			0.005	0.054
	(0.094)	(0.039)***			(0.058)	(0.048)
Obs.	6,901	14,324			1,388	2,733
Children 6-11						
Has Twin Sib. <6	-0.039	-0.169			0.007	0.096
	(0.107)	(0.051)***			(0.063)	(0.057)*
Obs.	6,366	10,955			1,297	2,144
Children 12-18						
Has Twin Sib. <6	-0.016	-0.018	0.079	-0.024	-0.071	-0.094
	(0.032)	(0.023)	(0.121)	(0.086)	(0.146)	(0.074)
Obs.	535	3,369	535	3,367	91	589
Children 12-15						
Has Twin Sib. <6	-0.021	0	0.01	0.044	-0.047	-0.063
	(0.031)	(0.022)	(0.098)	(0.088)	(0.161)	(0.068)
Obs.	471	2,765	471	2,763	79	481

Boys

	Years Education		Weekly Study Hours		Educational Progress	
	Twins-2	Twins-3	Twins-2	Twins-3	Twins-2	Twins-3
Children 6-18						
Has Twin Sib. <6	-0.103	0.025			0.066	0.032
	(0.061)*	(0.072)			(0.054)	(0.062)
Obs.	7,286	14,577			1,471	2,742
Children 6-11						
Has Twin Sib. <6	-0.117	0.039			0.078	0.007
	(0.066)*	(0.095)			(0.055)	(0.053)
Obs.	6,794	10,998			1,384	2,092
Children 12-18						
Has Twin Sib. <6	0.093	-0.025	0.037	-0.032	-0.015	0.12
	(0.025)***	(0.025)	(0.149)	(0.080)	(0.111)	(0.194)
Obs.	492	3,579	492	3,579	87	650
Children 12-15						
Has Twin Sib. <6	0.084	-0.035	0.043	-0.062	0.026	0.166
	(0.026)***	(0.025)	(0.149)	(0.077)	(0.113)	(0.215)
Obs.	409	2,959	409	2,959	72	539

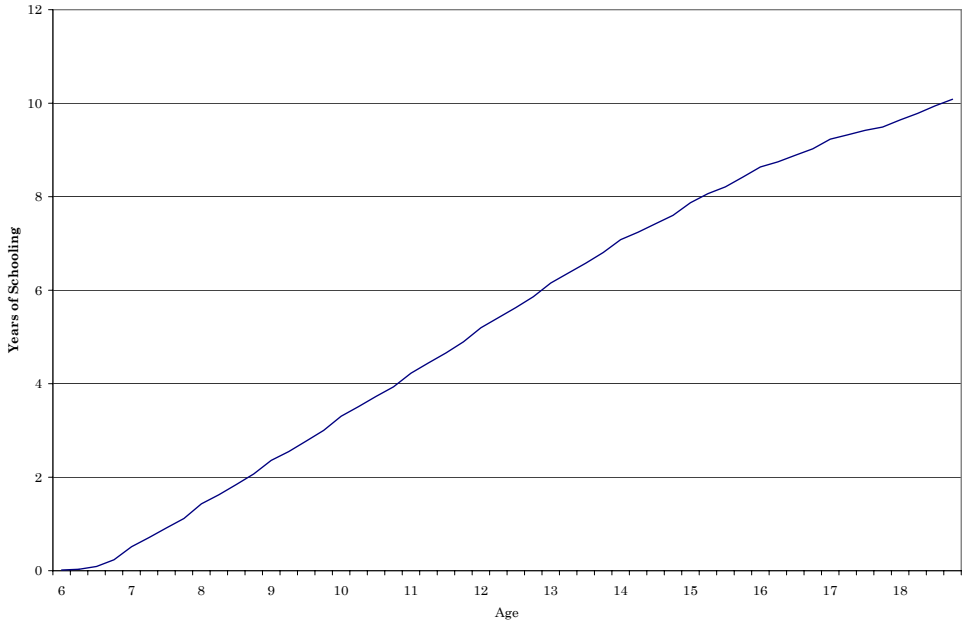

Figure 4.1: Years of Schooling by Age

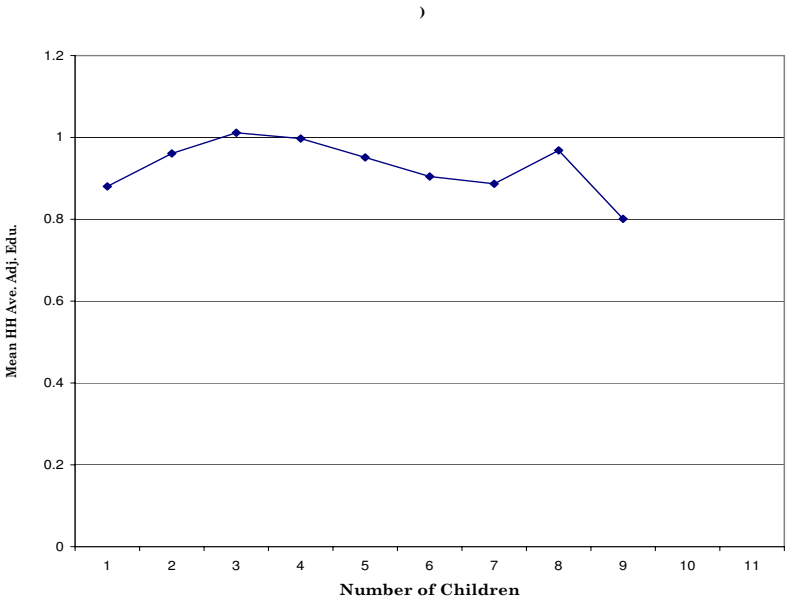

Figure 4.2: Mean Household Adjusted Education, by Number of Children (Nontwin Families)

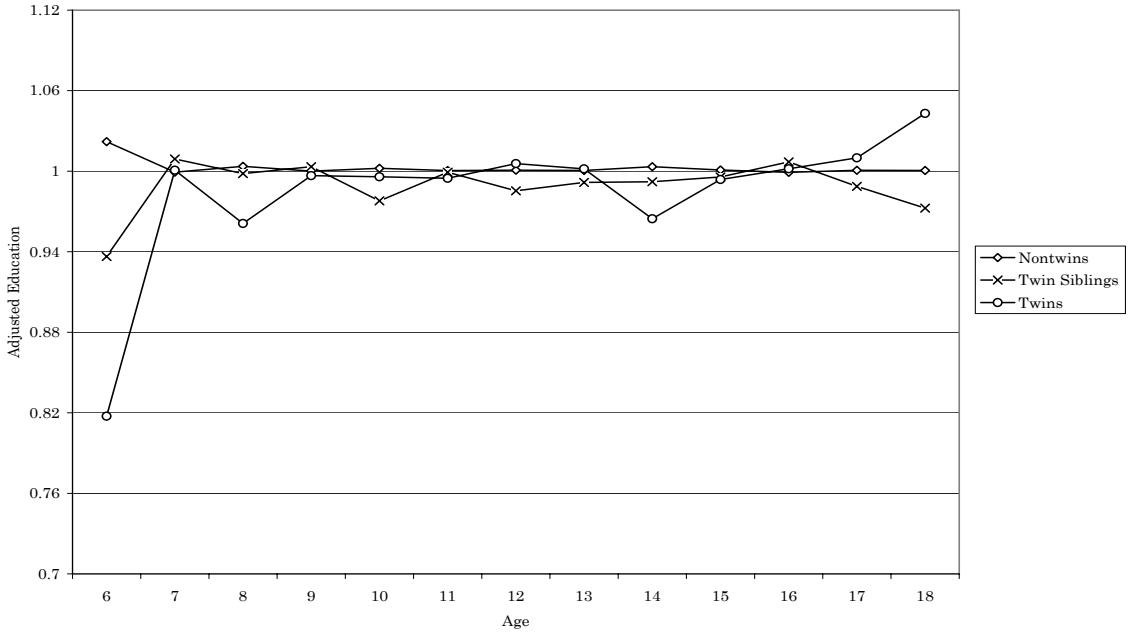

Figure 4.3: Adjusted Education by Age and Twin Status

Chapter 5

Conclusion

This thesis has investigated several ways in which the family is important for economic outcomes. Specifically, I have examined the time cost of additional children in the family, the role of household English skills in immigrant self-employment, and the effect of additional siblings on children's education. The results show that family and the household have an important effect on individuals' time use, employment decisions, and investment in human capital. However, when endogeneity is controlled for, estimates of women's time use in the house is much smaller than simple OLS results would indicate, and the effect of children on siblings' education is observed only for younger children.

In the second chapter, I analyze the effect of an additional child on time use in the home. While it has long been recognized that decisions on the amount of time spent doing housework are endogenous to decisions about fertility, it is difficult to find suitable instruments which allow the time cost of an additional child to be measured without bias. I take advantage of a unique data set which combines a large number of observations with questions on weekly hours of housework and information on all members of the household

to create a twins instrument which is exogenous to desired fertility for a given birth.

As expected, the data shows specialization of time use in Mexican households. While labor force participation of Mexican women has risen dramatically in recent decades, women continue to do almost all of the housework in the family. Mexican women increase their housework in response to an additional small child to the household. However, the increase is smaller than what might have been expected — only 3.5 hours. Approximately 1.2 hours of the increase comes from reduced leisure time. Spouses also increase housework in response to an additional child, by 1.2 hours, but have no reduction in leisure. The simple OLS estimates for the time cost of a child are also low, representing only a 13% increase on average in women's housework hours compared to hours before pregnancy. The OLS estimates are much greater for the first child, although men help out more for twins when there are already two previous births, indicating that as the value of time becomes very high, men do help out.

Rather than indicating that children are not time-intensive, I believe the results indicate that time use within the household is flexible and women can substitute their time from less productive home care activities to child care. In addition, the reduction in housework hours by itself may not be the primary impact of a young child. The timing of child care activities and the need to be available at all times may interfere with other types of production at home, in the workplace, and in leisure. How spouses divide the timing and type

of housework activities is an area that might be investigated. Specialization may occur not only between housework and market production, but between tasks that require one parent to be "on-call" and tasks that can be scheduled or performed on a more flexible basis as time becomes available.

Reductions in the quality of production are also of interest. One aspect of quality reduction that has been studied is the effect of additional children on the development of siblings, although this has usually been framed as a reduction in time devoted to other children, not a reduction in efficiency.

Finally, it would be of interest to examine how responsibility for home production is evolving over time. There has been a trend in developed countries for men to take more interest in child care, which is related to trends towards flexible work arrangements, to technological advances in the home, and to the increase in contracting and shorter tenures. Again, this may lead to different types of specialization within the home rather than the traditional division between home and market production. While this trend is likely to be more pronounced in the U.S. and Europe, the availability of additional years of the ENEU might provide the basis for such a study in Mexico. The roles of family in Mexico and the U.S. have been very different in the past. Will Mexican families come to resemble families in the U.S. more in terms of their time use?

The third chapter develops a simple model to show how trade in household English skills might encourage immigrant self-employment. While economists and sociologists have examined the role of English in self-employment in the context of immigrant enclaves, this is the first analysis that has examined

household English skills within the family and proposed an economic theory of how they might influence employment decisions. I use the U.S. Census to examine the hypothesis that individuals from households with a wider spread of English skills are more likely to be self-employed. I find that, in accordance with my model, a greater range of English skills in the household is associated with higher self-employment rates overall and for men who speak good or very good English. Also, the presence of someone with different language skills in the household encourages self-employment for both poor English speakers and very good English speakers. The percent increase in the probability of self-employment is fairly large.

This model might be adapted to examine other ways in which immigrants use self-employment or work together to minimize disadvantages they might face in the U.S. labor market. Immigrants might face signaling problems in translating overseas education into jobs in the U.S.. Self-employment may allow households an opportunity to provide work for family members who might otherwise not be able to find work in the wage labor market, such as young or old workers or workers willing to work for less than the minimum wage.

The fourth chapter examines the impact of an additional sibling on children's education. This is a topic that has been extensively studied, but generally without adequately controlling for endogeneity between the desired and actual number of children and educational decisions. I find that additional siblings have an observed negative effect on children's education only

for younger children. While the measure of education is coarse and does not account for quality, it appears that children who fall behind later catch up. Timing and age of the additional sibling matter, but the results vary by the instrument used. A close additional sibling has more of a negative impact for both girls and boys, but still no long-term effect.. For girls, a younger sibling in a family with more at least three births is associated with lower education. For boys 12-18, however, there is a positive effect on education to having a second sibling under the age of 5.

The data does not provide robust support for the quality-quantity model in the Mexican case. While the theory is appealing, the data provides more support for a model in which families compensate in other ways to achieve a target level of education. This implies that families tastes for education and the skill level of mothers determine education levels, not the number of children. In this context, coercive fertility reduction programs would have no direct effect on education levels, unless they changed the attitudes of client families. In the context of a system where educational opportunities are relative widespread and individual costs of education are not overwhelming, it may be that long-term benefits of education far outweigh the changes in the relative price of education caused by the birth of an additional child. These results are specific to urban areas of Mexico. Children in other countries, or in the Mexican countryside, may face different costs of education and may respond differently.

The paper indicates, however, that there are complex interactions be-

tween siblings. The question of how the relative spacing of births affects children's development warrants further investigation. It may be that older boys benefit from having more parental time spent in the home. The presence of a young child may reduce the per child cost of spending time in the house and increase "public time" parents spend in the house which is shared by all children.

Overall, the role of family is important. Different family structures lead to different outcomes. Family and household structures in the U.S. and Mexico are changing in response to economic development and social trends, How individuals are effected by this change is an important question for future research. The smaller estimates of estimates of the effect of a child accounting for endogeneity compared to simple OLS estimates emphasize the importance of addressing simultaneity issues. It is also difficult to model who is making family decisions and on what basis. However, with numerous household data sets becoming available in a wide range of countries, there is great scope for additional research into family relationships and economic outcomes.

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